American Machinist

Volume 65 New York, November 18, 1926 Number 21

Two Special Tools Used in Making Rock Drills

By B. R. Sheets
Chief Draftsman, Denver Rock Drill Mfg. Co.

Steps in the development of a machine for drilling radial holes in the interior of a small cylinder—Lathe converted into a multi-spindle drill

THE drilling of small internal holes, as shown in Fig. 1, is an example of an unusual operation that has been responsible for the design of the three types of special machines illustrated in Figs. 2 to 5, Fig. 2 being the first, Fig. 3 the second, and Figs. 4 and 5 the final machine.

The machine shown in Fig. 2 was designed to suit one job only and for one size drill having a constant speed. The drill chuck at *A* is driven by a sprocket and chain inclosed in the spindle *B*. The work is mounted on a fixture which slides in ways at *C* and is clamped by the lever *D*. A ¾-in. drill is the largest handled.

The machine illustrated in Fig. 3 was designed along the same general lines as the one in the previous illustration, with the addition of several refinements. The drive is provided with variable speeds to accommodate drills from ⅞ to ¾ in. The work holding fixture is clamped by a taper gib operated by the lever *A*, through a rack and pinion. A stop drum has been added at *C* for positioning of the work for holes of different depths. The feed is operated by the handle *B*, through spur gear and pinion, worm and nut. On both of these machines, the coolant is supplied by a gear pump and is conducted through the spindle, striking the drill at an angle.

The latest development of this type of machine is shown in Figs. 4 and 5. The machine was designed especially for the part illustrated in Fig. 1. The work is held in the fixture by the clamp at *A*, Fig. 4. The fixture is indexed for location of the various holes by the groove *B*, holes *C* and the index plunger *D*, thus making the operation fool-proof. Once the piece is in place, the fixture can be indexed only to the proper positions for the various holes. The drill spindle is fed vertically by a cam operated by the pilot wheel *A*, Fig. 5. An adjustable stop at *B* controls the depth of the hole.

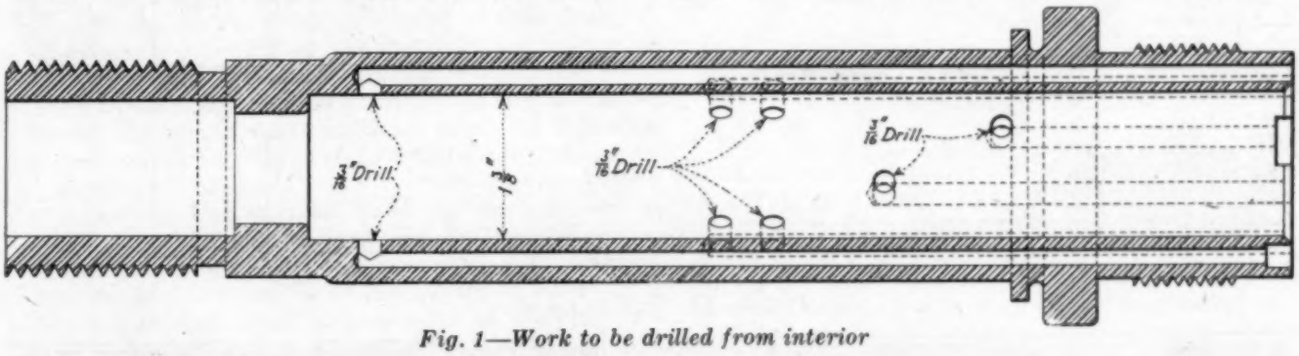
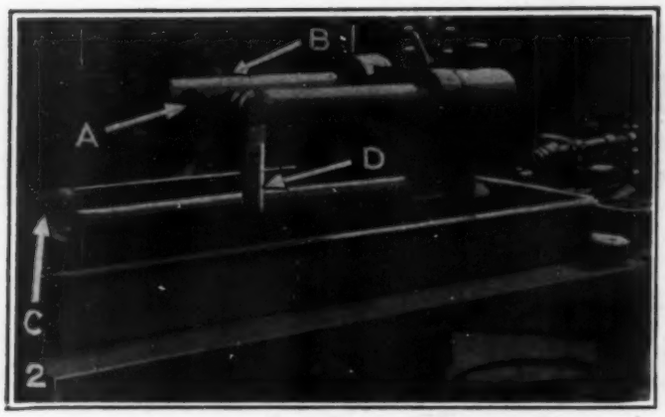


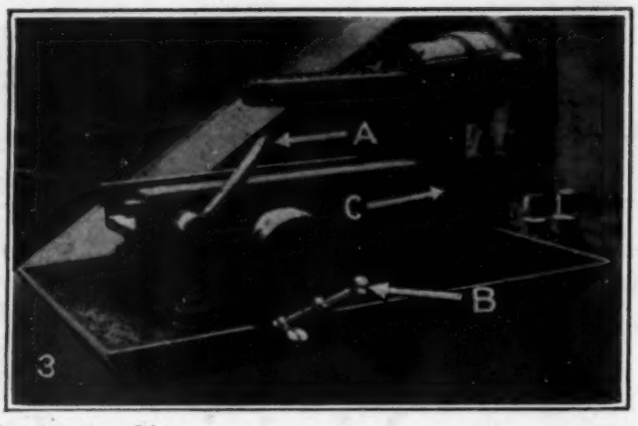
Fig. 1—Work to be drilled from interior

The machine is equipped with individual ¼-hp. motor drive and is mounted on a portable table, making the unit easily movable from one section of the plant to another when the occasion demands it.

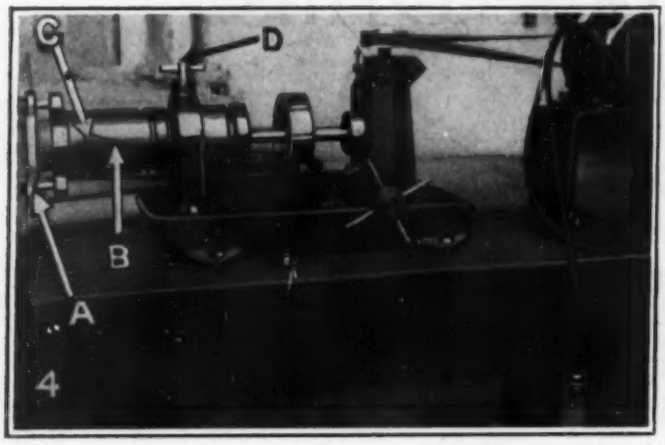
A drawing of the spindle of this machine is shown in Fig. 6, and illustrates the construction and the method of driving the drill. The oil used as a coolant passes through the spindle and lubricates the driving gears. Oil is supplied by a pump located in the base of the machine, at the end of the drive shaft.

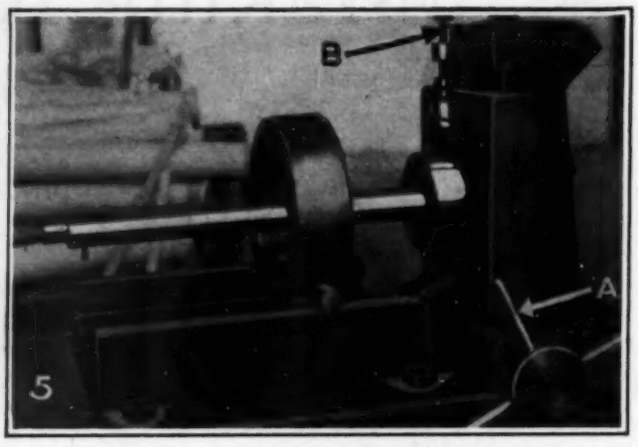
Another unusual adaptation of standard equipment in the manufacture of rock drills is illustrated in Figs. 7 and 8. A three-spindle drilling head attached to an old American engine lathe, with an indexing fixture





Figs. 2 and 3—The first two machines





Figs. 4 and 5—The final machine

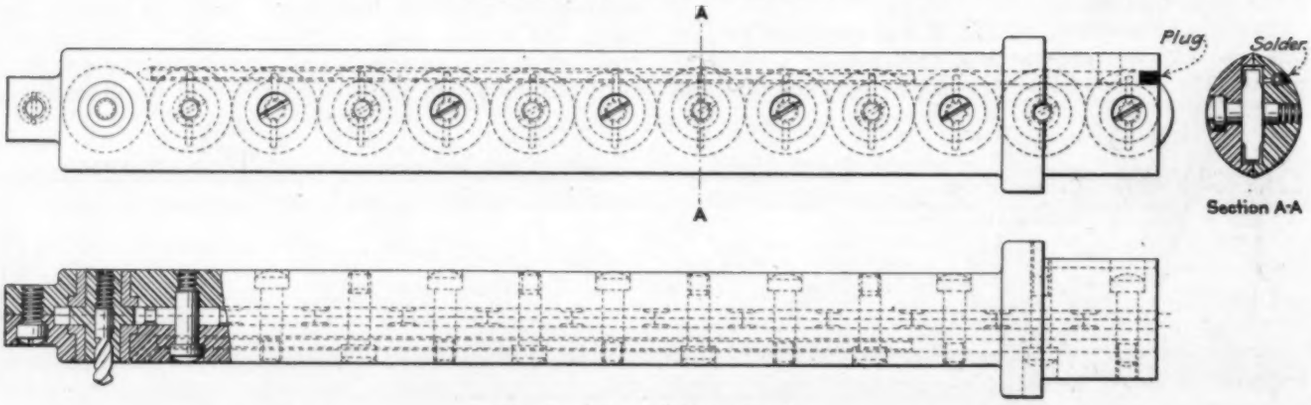
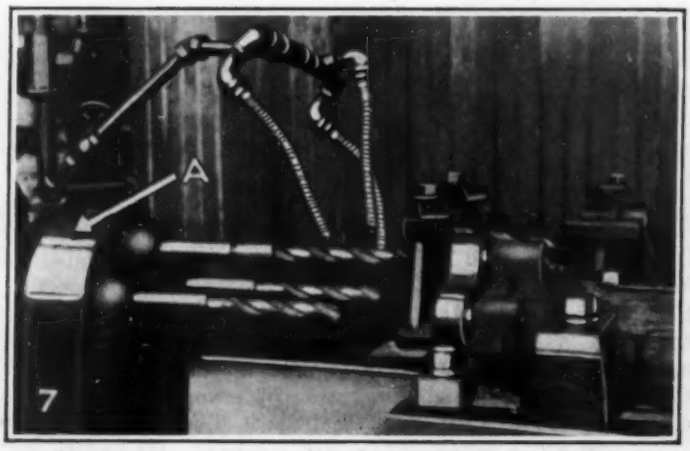
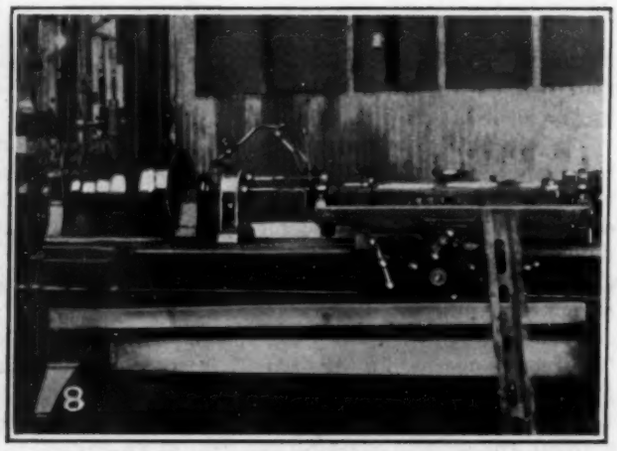


Fig. 6—The drilling spindle





Figs. 7 and 8—Lathe converted for drilling

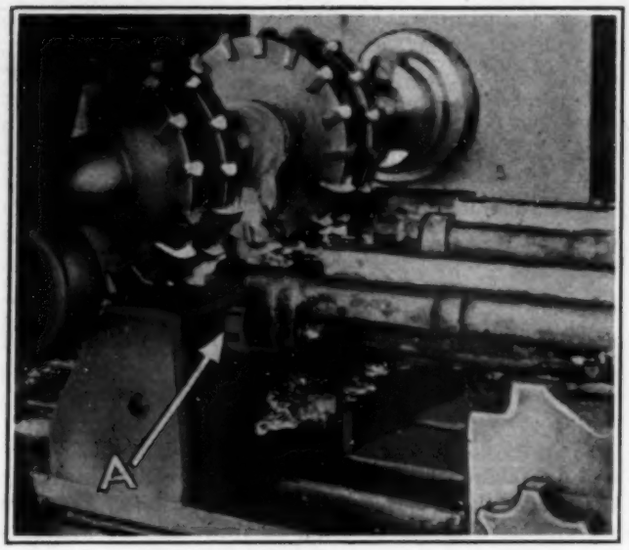


Fig. 9—Milling the ways

for drilling three holes in both ends of the mounting-slide casting, is shown in Fig. 7 at *A*.

The general layout of the fixture and head can be seen in Fig. 8, while Fig. 7 shows the method of clamping the work and holding the drill bushings. The three spindles are driven from the headstock spindle through spur gears running in oil. This method not only put an old machine into use, but effected quite a saving of time over the old method of jig drilling under a radial drill. Two rectangular ways are later milled, see Fig. 9, to very close limits, and care must be taken that the ways are milled in proper relation to the rough casting, to provide clearance for the rock drill when it is mounted in the shell.

Considerable trouble and re-work was experienced until the job was lined up as here illustrated. In the first or drilling operation illustrated in Figs. 7 and 8, the work is located from the inside of the casting by spring-actuated locating plugs, thus bringing the three holes in each end in proper relation to the casting to insure the proper clearance, since in all the following operations the work is located from these original holes. The operation shown in Fig. 9 is the first milling. Note the locating pins at *A* by which the work is held to proper location from the three holes drilled before. This operation, which removes the volume of stock preparatory to the finish milling of the ways, is handled by a No. 4 Cincinnati plain milling machine carrying two gangs of inserted-tooth cutters, which stand a feed of 3½ in. per min. The fixture is huskily built to withstand this feed and maintain accuracy.

Between 1914 and 1923 production increased faster than the number of workers, indicating an increased output per man. This is largely because of better machinery and more power per man being used in factories.

"Not for an hour, not for a day, but always," seems to be the motto of the pipe-fitting department of the Commonwealth Steel Co., St. Louis, Mo. The last report gave it 1,150 days without a lost-time accident, during which time over 357,000 ft., or 67 miles, of pipe were handled. Safety seems to be a habit in the plant as 15 divisions have a record of 100 consecutive days without a lost-time accident.

Seen and Heard

By John R. Godfrey

Another angle on special machines—Hydraulic feed

THE special machine proposition has a number of angles. And this doesn't mean so much the built-to-order machine as it does standard machines that have certain features added or omitted as the case may be. I remember the argument one of the early builders of lathes with gear feed boxes gave me when I suggested that he build some lathes with only two or three feeds for production shops. He contended that the purchaser had better pay the extra price, whether he wanted all the feeds or not so as to be able to sell the lathe more easily when he wanted to dispose of it.

This argument didn't appeal very strongly when I thought of the lathes that did service years after they ought to be scrapped. Figuring on the resale value doesn't seem to be the way to buy a production machine.

Now another lathe builder gives me a different slant on the subject. And it seems to have some real points to think about.

"We are not building many standard lathes now. That is we are leaving off certain parts such as cross slides, or making turrets just suited for the special work to be done. We've always rather objected to this but now we encourage it, at least we don't protest seriously.

"It has been our experience that few of these special machines are easy to sell in the second-hand market. The customer either wants a standard machine or one that is different from the one offered. We believe we get more orders for new machines that we would if we built all machines standard."

Which is another way of looking at the question and may be worth thinking about.

Experience—Whose Is It?—Discussion

By Lawrence F. Swenson

Experience is a form of knowledge stored in a man's mind, and no manager or company can lay claim to its ownership as is sometimes attempted when a man leaves for a better job. The case cited by Entropy on page 584, Vol. 65, of the *American Machinist* is typical of the old fashioned manager who expected men to be fixtures and became angry when a good man moved on.

With the specialized machinists, or operators, so common today, the cost of furnishing experience is much lower than in years gone by. It is an everyday occurrence in large shops to hire unskilled men and break them in. They are taught how to do one thing, and that is often the end of their training. These men begin to produce almost immediately after being hired, and certainly do not owe much to the company in case they leave. The long time apprentice, on the other hand, receives small wages while in training, which largely offsets the difference in value between his production and that of the skilled mechanic. Here again it appears that the apprentice and the company are about even when the training period is over.

In order to overcome the possible loss of this experience it is very necessary that the man is kept in a satisfied frame of mind or he will move to the competitor's shop. When he goes, his training goes with him.

France as Machinery Market

UNDER the Treaty of Versailles, France took over the iron and steel producing area of Alsace-Lorraine, with the result that France now occupies a much more important position as a producer of these materials than in pre-war years, according to reports of the Department of Commerce. Also, the industry in Luxemburg was formerly rather closely related to that of Germany but has since become affiliated with that of Belgium which is again influenced by France. Consequently, since the Armistice the position of France has improved greatly and what France has gained, Germany has lost.

Because of this increased capacity for production of iron and steel, it is to be expected that the French machinery industry would also be stimulated and, since the Armistice, it has been exceedingly interesting to observe how the French have taken advantage of this situation. Notwithstanding a greatly increased domestic consumption, France imported in 1925, 50,000 metric tons less machinery than in 1913, a reduction of 40 per cent. Exports increased 50,000 tons, or 185 per cent during the same period.

Production Tripled Since 1913

The expansion of metal working machinery is probably greater than that for any other class of machinery manufactured in France. It has been estimated that the present French production of metal working machinery is more than three times the volume of 1913. In that year the French imports of metal working machinery amounted to 23,732 tons and by 1925 this had decreased to 12,535 tons, a reduction of nearly 50 per cent. French exports during the same period rose from 3,770 tons to 11,171 tons.

Of the 1913 imports, Germany was the most important contributor, with 11,908 tons. Great Britain and the United States contributed 4,937 tons and 4,101 tons, respectively. By 1925 this situation had changed. Germany furnished only 4,171 tons, Great Britain 1,518 tons, and the United States 3,207 tons. This is a very interesting contrast and a record that should interest American manufacturers.

Although the German exports to France exceed those of the United States by nearly 1,000 tons in 1925, they represented a value nearly four million francs less than the American total. Clearly, the United States is sending a higher class of machinery into France than is Germany. American sales effort in France must necessarily be organized to support machinery of high quality.

As might be expected, it has been exceedingly difficult for American manufacturers of the simpler types of metal working machinery to compete with their French colleagues in that market. On the other hand, there has been an increasing demand for the more specialized types of American metal working machinery and the French market may be depended upon to absorb an important volume of equipment used in quantity production. For these special machines there is less competition from local manufacturers because the French market has not been large enough to encourage the local manufacturers to take up this class of work. It will be, probably, many years before they will be able to make machines of the American standard even if their market should justify work along these lines.

In the French market the competition to be faced by American manufacturers of production machinery is that which comes from Germany and Great Britain, especially the former. Not only are German machine tool manufacturers duplicating many American special machines, but are selling these copies on the French market at prices 15 to 20 per cent below the prices asked for the American originals. In many cases, the German manufacturers are extending credit of from four to six months. It has been reported that German machinery salesmen are being sent into France to get the business with a certain disregard for the usual prices. Many German firms are said to be installing machine tools in French plants on a trial basis with the understanding that if the equipment does not give satisfaction it can be returned at the manufacturer's expense.

Because of their proximity to France, machinery manufacturers in Germany and Great Britain enjoy advantages over those in the United States. They are not only in a better position to study the French psychology, but any misunderstanding arising can be more easily adjusted because a representative can usually be on the spot within twenty-four hours.

Notwithstanding all this, sales in France of American special metal working machinery are steadily increasing, since the leading French manufacturers recognize the superiority of the American product. In fact, the complaint is often heard that some of the American special machinery has too high a production for the French market.

Secondary Operations on Parts Produced by Automatic Machines—Discussion

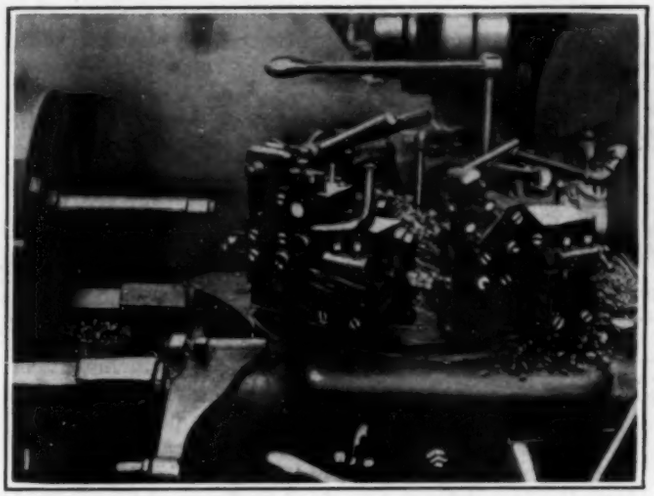
By H. Applegard
Halifax, England

I have noted the article by Harry G. Brown, under the title given above, published on page 8, Vol. 65, of the *American Machinist*. May I say in reply that the type of automatic on which the parts were produced is not the B & S machine. It was not feasible to use either a thread-roll or swing-tool attachment in the type of machine employed, and consequently the order of operations had to be as stated in order to produce the parts as economically as possible.

I was interested, however, in the suggestions made by Mr. Brown. In the case of part *A*, the diameter of the tenons was only one third of the diameter of the rod, and it is questionable whether the use of a swing tool with support would prevent the parts from being broken off. As to the question of thread rolling, in the case of part *J*, for example, the accuracy and finish required would in any case preclude the use of a thread roll. However suitable this method of producing threads may be in the cheaper variety of screws, it is not satisfactory when working to fine limits.

In part *H* the quantity was only 2,000 and the size of rod, $\frac{7}{16}$ x $\frac{1}{2}$ in., would need to be drawn especially thus making the cost prohibitive. The alternative method of making from round stock and milling flats did not prove satisfactory, since too large a percentage of the heads broke off in the milling process, besides being the more expensive.

I omitted to state that the rods were annealed previous to being used, the diameter being $\frac{3}{8}$ in. and when flattened out to $\frac{7}{16}$ in. no cracks were in evidence, and the finished screws were quite good.



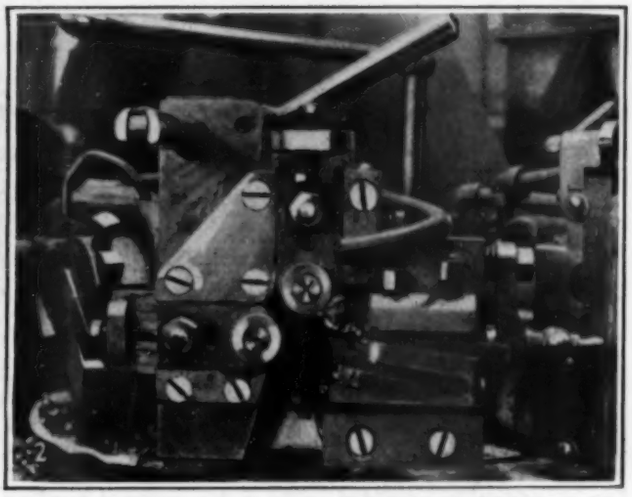


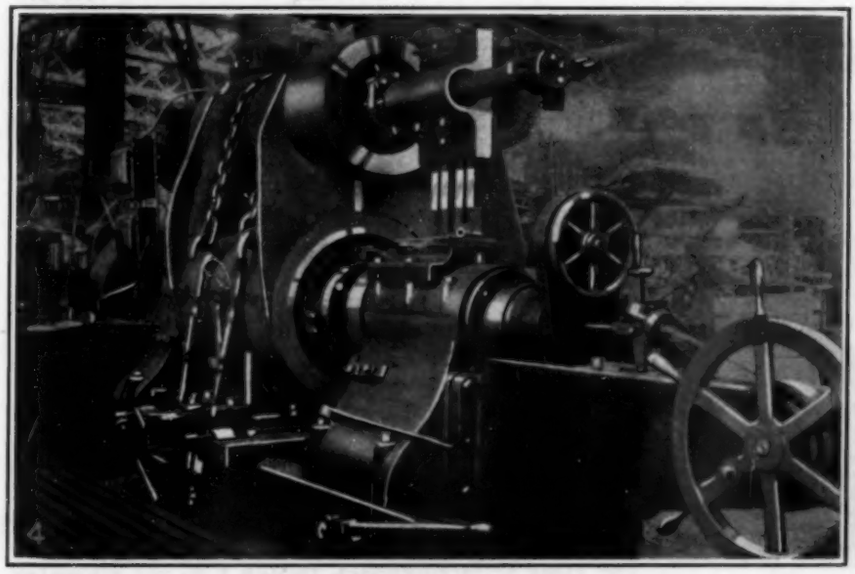
Fig. 1—Turning a forged crank-arm-bolt. Fig. 2—Close-up view of taper-turning attachment

A Miscellany of Tools at the Great Northern Shops

By Frank W. Curtis
Western Editor, *American Machinist*.

AMONG the latest tooling devices developed in the Great Northern Ry. Co.'s shops at St. Paul, Minn., is the attachment for turning tapered bolts, pins and studs, illustrated in Fig. 1. The device is known as the Prydz roller taper turner. It can be used in any turret lathe, and unlike most taper-turning attachments its rollers and cutting tools work in unison in relation to the angle of the taper being turned, so that a positive support is obtained. This feature is made possible by a series of sliding plates having angular tongues and contacting surfaces so arranged that a uniform movement is transferred to the tool slide and the two roller slides. The work shown is a forged crank-arm bolt to be chamfered, turned and threaded. For the taper-turning cut a Stellite tool is used. The work runs at 300 r.p.m. and the feed is $\frac{3}{32}$ in. per rev. The depth of the cut is approximately $\frac{1}{4}$ in. and the taper is $\frac{1}{8}$ in. per foot. Soda-water is used for a coolant. The machining time is $4\frac{1}{2}$ min., but since the operator is required to measure the sizes, this time varies somewhat.

A close-up view of the roller taper turner is shown



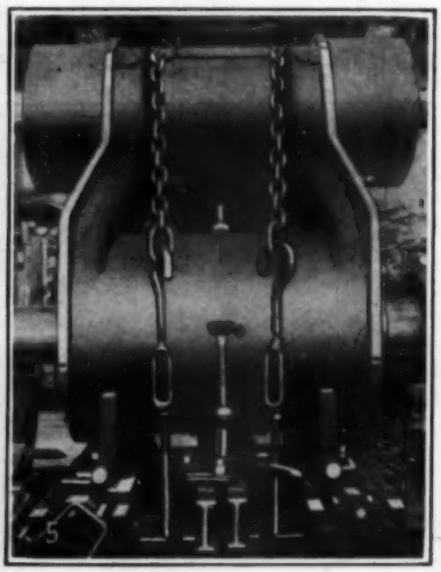


Fig. 4—Horizontal boring machine for cylinders. Fig. 5—How the cylinder is clamped

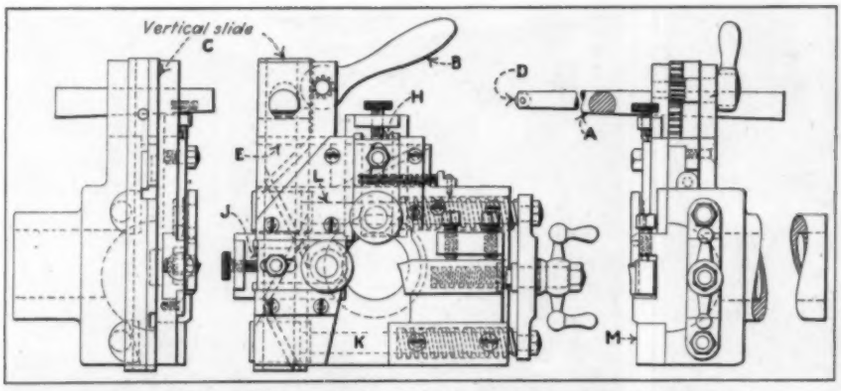


Fig. 3—Constructional details of taper turning attachment

in Fig. 2 and the constructional details are shown in Fig. 3. The movement of the slide is controlled by the bar *A* which is provided with a flat tapered surface on its underneath face. The tapered surface of the bar is made to correspond with the taper of the work, so that if a change from one taper to another is required, it is necessary to change bars. Since there are but four or five different tapers used in this class of work, a similar number of bars is required, and the change is made rapidly. The bar is set in place by raising the lever *B* which forces the vertical slide down and allows the bar to be inserted in the hole. When the lever is released, the bar is held by the vertical slide *C* through spring pressure.

In operation, the end *D* of the bar *A* strikes a stop on the headstock of the machine causing the bar to remain stationary as the turret continues to feed, and, through the sliding movement of the bar, the vertical slide is engaged accordingly. The length of the vertical slide is equal to the height of the tool body, and from it the cross-slides are operated. The cross-slide *E*, operates the roller slide *H* and the roller slide *J* which is directly connected to the vertical slide. Two plungers *K* and *L*, connected to the vertical slide, are used to engage the tool slide *M*. The compound movement of the slides can be checked by starting with the tool slide, which has a tendency to crowd away from the work when the tool is engaged.

The plungers attached to the tool slide move in the same direction, and, through the angular tongues in the outer ends, the vertical slide is forced upward. The tapered bar *A* limits this motion, however, in relation to the travel of the turret. Upward movement of the vertical slide likewise draws the roller slide *J* away from the work, and also causes the cross-slide *E* to move the roller slide *H* in an upward direction. The tool slide and the roller slides are provided with individual adjustments that are independent of the movement of the vertical slide. This feature enables a quick set-up when different tapers are turned. The attachment is compact in design, and enables the turning of accurate, uniform tapers. The attachment is used for straight work by leaving the bar *A* in a stationary position.

For boring cylinders, the Niles horizontal boring machine, shown in Fig. 4, is used. An additional boring attachment has been added to the machine, so that both the cylinder- and the valve-chamber bores can be machined at one setting. The boring attachment is fastened to the head and tailstocks by upright slides that allow a vertical movement of the boring bar, to correspond with the center distance of the two bores. An individual motor is used to drive the bar for boring the valve chamber. The cylinder rests in split V-blocks, the halves of which can be moved independently, so that the bore can be adjusted to a proper height and in line with the spindle of the machine. To line up the valve-chamber bore in a vertical plane with the cylinder bore, two jacks are provided in the rear of the machine. Clamping is done by two chains tightened by turnbuckles. Both bores are counterbored, and the four end-faces are machined at the same setting.

In Fig. 5 is shown a close-up of the clamping arrangement and the V-blocks used for aligning the work.

Upon completion of the boring operation, the cylinders are held separately in a fixture in a Morton draw-cut shaper, and are machined on the splice face, upper and lower frame surfaces, intake flange and the bottom of the center-casting flange. Then the necessary drilling is done, after which the cylinders are assembled in pairs, laid out and returned to the draw-cut shaper where the saddle and the exhaust pads are machined as shown in Fig. 6. Roughing and finishing cuts are required on both surfaces.

(To be concluded)

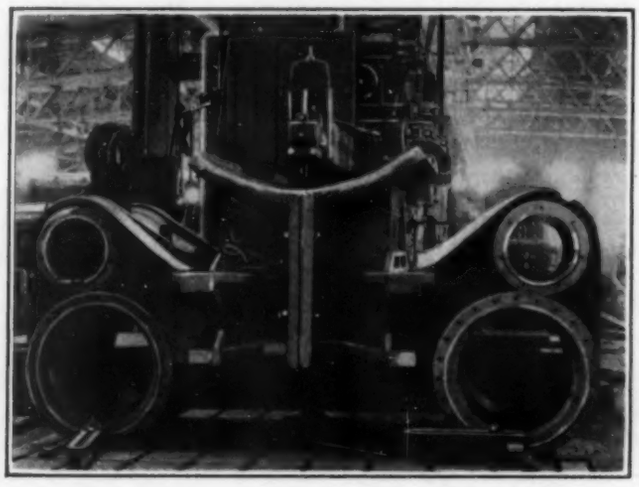


Fig. 6—Machining the saddle

Smoking in the Shop

By P. W. Druitt
Bayswater, England

A plan, attended with satisfactory results for permitting and regulating smoking in works during working hours, may prove of interest. The object was to prevent the waste of time by employees smoking and loitering outside, and to provide some small relaxation.

Smoking was permitted for half an hour during the forenoon and for a like period during the afternoon on the understanding that no smoking or loitering on the outside should occur.

The result proved highly satisfactory, the employees showing by their conduct that they appreciated the arrangement. A feature of the scheme was the formation by the workers themselves of a committee to deal with any cases of infringement, though I do not remember anything of the like occurring.

Gear Teeth in Action

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

The beam strength of gear teeth and the various modifying factors—The Lewis formula—Results of tests by Marx and Cutter — Effect of errors on velocity factor

THE strength of gear teeth and the amount of power that can safely be transmitted by them are still open questions. So many variable and uncertain factors are involved that it is not surprising that a wide variety of different formulas and rules have been proposed from time to time. Few, if any, systematic experiments were made to obtain data on this subject until about 1911, when Prof. Guido H. Marx of Stanford University started a series of tests, the results of which have been published in several papers presented before the American Society of Mechanical Engineers.

The present object is to review existing data on the strength and durability of gear teeth. The purpose of gears is to transmit power efficiently, quietly, and with reasonable life. To accomplish this, three different factors must be considered: the strength of the tooth considered as a beam, the durability of the tooth surfaces in action under load, and the efficiency of the gears. These three factors will be considered individually.

In 1879, John H. Cooper made an investigation of the subject of strength of gear teeth and found that there were then in existence about forty-eight well-established rules for horsepower and working strength differing from each other in extreme cases about 500 per cent. Summing up, he selected the following formula for cast-iron gear teeth from an English rule published in 1868:

$$X = 2{,}000\,pf$$

Where X = breaking load on gear tooth, lb.
p = circular pitch of gear, in.
f = width of face of teeth, in.

In conclusion, he makes this pertinent remark: "It must be admitted that the shape of the tooth has something to do with its strength, and yet no allowance appears to have been made by the rules tabulated above, the breaking strength being based upon the pitch or thickness of the teeth at the pitch line or circle, as if the thickness at the root of the teeth were the same in all cases as it is at the pitch line."

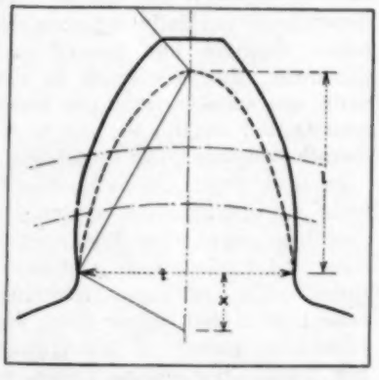


Fig. 25—Graphical method of determining the Lewis form factor

The eighth article. The ninth will appear in an early issue.

In 1886, Prof. Wm. Harkness found from an examination of the bibliography of the subject, dating back to 1796, that, according to the constants and formulas used by various authors, there were differences of 15 to 1 in the power that could be transmitted by a given pair of gears. As a result of his investigations, he found that all of these formulas might be expressed in one of the three following forms:

$$\text{Horsepower} = CVpf \text{ or } CVp^2 \text{ or } CVp^2f$$

Where C = coefficient, or constant
V = pitch-line velocity, ft. per sec.
p = circular pitch of gear, in.
f = width of face of teeth, in.

As a result of his examinations, Professor Harkness proposed the following formula for cast-iron gears:

$$\text{Hp.} = \frac{0.910Vpf}{\sqrt{1 + 0.65V}}$$

The various factors that affect the strength of gear teeth and that should be included in a complete formula may be summed up as follows:

1—The physical characteristics of the material of which the gear is made
2—The shape and size of the gear teeth
3—The point on the gear tooth profile where the maximum load is applied
4—The consideration of whether the load is at any time carried by a single tooth or whether it is divided between two teeth
5—The influence of velocity in causing the teeth to break by shock
6—The influence of errors in the gear tooth profiles in causing greater or less shock loads
7—The influence of the rotating masses driven by the gear teeth in causing greater or less shock loads
8—The character of the load transmitted; that is, whether the load is steady, or suddenly applied; or variable and subject to sudden overloads
9—The factor of safety used to cover all the uncertainties of the other factors and to insure working stresses safely within the ultimate strength of the material employed.

Wilfred Lewis seems to have been the first to use the form of the gear tooth as one of the factors in a formula for the strength of gear teeth. The Lewis formula which has become the one most widely used today was presented in a paper read before the Engineers' Club of Philadelphia on Oct. 15, 1892. This formula is as follows:

$$W = spfy$$

Where W = transmitted tooth load, lb.
s = safe working stress in material, lb. per sq.in.
p = circular pitch, in.

f = width of face of gear, in.
y = tooth form factor.

The factor y is obtained by considering the gear tooth as a beam, fixed at one end and loaded at the other. This factor may be obtained graphically, and in Fig. 25 this is done.

We have for the strength of such a beam

$$W = \frac{sft^2}{6l}$$

Where W = load, lb.
s = maximum fiber stress, lb. per sq.in.
f = width of beam, in.
t = thickness of beam, in.
l = length of beam, in.

It can be shown by similar triangles in Fig. 25 that

$$x = \frac{t^2}{4l}$$

Substituting this value in the equation, we have

$$W = sf\frac{2x}{3} \text{ or, for the gear tooth } W = spf\frac{2x}{3p}$$

Whence, $$y = \frac{2x}{3p}$$

These values for y for several different gear tooth systems are assembled in Table I.

Wilfred Lewis makes the following statement in his paper: "What fiber stress is allowable under different circumstances and conditions cannot be definitely settled at present, nor is it probable that any conclusion will be acceptable to engineers unless based upon carefully made experiments." He then gives for use in the absence of anything more definite a table of safe working stresses for cast iron and steel for pitch-line velocities ranging from 100 to 2,400 ft. per min. These values were established from a series of factors credited to E. R. Walker, New Castle-under-Lyme, 1868. These factors were later put into the form of the following equation by Carl G. Barth:

$$s = \frac{600S}{600 + V}$$

Where s = safe working stress, lb. per sq.in.
S = safe static stress, lb. per sq.in.
= ⅓ elastic limit of the material
V = pitch-line velocity, ft. per min.

Referring to the several factors that affect the strength of gear teeth, it will be seen that the Lewis formula includes the following:

1—Strength of material used in the gears
2—Shape and size of gear teeth
3—The point on the gear tooth where the load is applied is assumed to be at the tip. This is seldom true, but any error resulting from this assumption is on the safe side
4—The load is assumed to be carried by one tooth. Any error resulting from this assumption is also on the safe side
5—The influence of velocity
9—A factor of safety of 3 is included in the value of the safe static stress.

The following factors have not been included:

6—Influence of the extent of errors in the gear tooth profiles
7—Influence of the rotating masses
8—The character of the load.

As a matter of fact, for high-speed gears the order of accuracy in the gear tooth profiles is necessarily much higher than in commercial low-speed gear drives in order to secure smooth operation, and the Barth equation, which determines the velocity factor, is often altered to the following:

$$s = \frac{1{,}200S}{1{,}200 + V}$$

In effect, this change in the constant from 600 to 1,200 introduces an accuracy factor.

In practice, the influence of the rotating masses and the influence of the character of the load are taken care of through the use of larger factors of safety, determined partially by experience. In general, the Lewis formula has proved satisfactory in practice. Generally, the safe loads as determined by this formula are smaller than the loads that actually can be transmitted safely, as has been proved by successful installations carrying theoretical excess loads.

In 1911, Prof. Guido H. Marx undertook a series of tests to obtain more definite data on this subject. Cast-iron gears were driven at various pitch-line velocities and loaded with a prony brake until the teeth failed. His first paper, covering tests up to pitch-line velocities of 600 ft. per min., was presented before the American Society of Mechanical Engineers in December, 1912. His second paper, written in collaboration with Prof. Lawrence E. Cutter, was presented before the same society in September, 1915. In this second paper was given the results of a continuation of these tests up to a pitch-line velocity of 2,000 ft. per min.

Table I—Values of the Beam Factor y for Use in the Lewis Formula

Number of Teeth	Gear Tooth System			
	14½-Deg. Composite and Generated	20-Deg. Full Depth	20-Deg. Stub	14½-Deg. Variable Center Distance
10	0.056	0.064	0.083	0.131
11	0.061	0.072	0.092	0.128
12	0.067	0.078	0.099	0.125
13	0.071	0.083	0.103	0.123
14	0.075	0.088	0.108	0.121
15	0.078	0.092	0.111	0.120
16	0.081	0.094	0.115	0.120
17	0.084	0.096	0.117	0.120
18	0.086	0.098	0.120	0.120
19	0.088	0.100	0.123	0.119
20	0.090	0.102	0.125	0.119
21	0.092	0.104	0.127	0.119
23	0.094	0.106	0.130	0.119
25	0.097	0.108	0.133	0.118
27	0.099	0.111	0.136	0.116
30	0.101	0.114	0.139	0.114
34	0.104	0.118	0.142	0.112
38	0.106	0.122	0.145	0.110
43	0.108	0.126	0.147	0.108
50	0.110	0.130	0.151	0.110
60	0.113	0.134	0.154	0.113
75	0.115	0.138	0.158	0.115
100	0.117	0.142	0.161	0.117
150	0.119	0.146	0.165	0.119
300	0.122	0.150	0.170	0.122
Rack	0.124	0.154	0.175	0.124

Table II—Values of v and a for Use in the Marx and Cutter Formula

Values of v			Values of v			Values of a			
Pitch Velocity Feet per Min.	14½-Deg. Composite System	20-Deg. Stub-Tooth System	Pitch Velocity Feet per Min.	14½-Deg. Composite System	20-Deg. Stub-Tooth System	Teeth in Engaging Gears		14½-Deg. Composite System	20-Deg. Stub-Tooth System
0	1.000	1.000	1,000	0.485	0.550	Single Tooth Engages		1.00	1.00
100	0.795	0.825	1,100	0.470	0.540	12	12	1.10	1.13
200	0.730	0.755	1,200	0.455	0.525	20	30	1.15	1.20
300	0.675	0.705	1,300	0.445	0.515	30	30	1.47	1.22
400	0.635	0.665	1,400	0.435	0.505	30	40	1.60	1.24
500	0.595	0.635	1,500	0.430	0.495	30	60	1.60	1.25
600	0.565	0.615	1,600	0.420	0.485	30	80	1.60	1.26
700	0.540	0.595	1,700	0.415	0.475	30	100	1.60	1.27
800	0.520	0.580	1,800	0.410	0.470	30	Rack	1.60	1.29
900	0.500	0.565	1,900	0.405	0.460	100	100	1.60	1.31
1,000	0.485	0.550	2,000	0.400	0.450	100	Rack	1.60	1.33

A third paper by Lloyd J. Franklin and Charles H. Smith gave the results of further tests made under Professor Marx's direction with gears of varying degrees of accuracy consistent with commercial production of cast-iron gears.

The first two series of tests were planned to determine the following:

1—The values of velocity coefficients at pitch-line speeds from zero to 2,000 ft. per min. on cast-iron, 14½-deg. composite tooth form and 20-deg. stub tooth form gears

2—The values of arc-of-action coefficients for the same tooth form

3—Experimental values of tooth form factors. (Lewis y factor)

From the results of these tests, the following formulas were developed:

For 14½-deg. composite tooth gears

$$W = \frac{1}{k}\, spf \left(0.154 - \frac{1.26}{n}\right) va$$

For 20-deg. stub tooth gears

$$W = \frac{1}{k}\, spf \left(0.278 - \frac{2.69}{n}\right) va$$

Where W = safe tooth load, lb.
s = modulus of rupture = 36,000 lb. per sq.in. for cast iron
p = circular pitch, in.
f = width of face of gear, in.
n = number of teeth in gear
v = velocity coefficient
a = arc-of-action coefficient
k = factor of safety.

The following factors of safety are suggested by Professor Marx:

k = 4, for steady loads with no reversal of stress
k = 6, for suddenly applied loads with no reversal of stress
k = 8, for suddenly applied loads with reversal of stress.

Table II gives values for the velocity coefficient v and the arc-of-action coefficient a, which were determined from these experiments.

The Marx and Cutter formula introduces a factor for duration of contact, different factors of safety for different kinds of loads, and experimental values for the tooth form and velocity factors; otherwise, it is essentially the same as the Lewis formula. These experiments showed that the tooth-form factors as calculated by Lewis were smaller than those determined by actual breaking tests; that a greater duration of contact increased the load required to break the teeth; and that the velocity factor, as given by the Barth equation, was appreciably different from that obtained in actual tests. The test values were smaller at low pitch-line velocities and greater at the higher velocities than those obtained by means of the Barth equation.

In the discussion that followed the presentation of the first paper by Professor Marx, Ralph E. Flanders remarked: "It is also important to know how much the accuracy of the cutting affects the strength of the gears at high speeds. All grades of accuracy are used in commercial work." In 1924, Franklin and Smith undertook a series of tests with 60-tooth, 10-D.P., cast-iron gears made to varying degrees of accuracy. The first series of gears had errors of the order of 0.001 in.: the second series, 0.002 in.: and the third series, 0.006 in. The tests were run on the same apparatus as that used by

Table III—Values for Velocity Coefficients for Gears Having Different Errors (Franklin and Smith)

Error in Gears In.	Pitch-Line Velocity in Feet per Minute										
	Zero	100	200	300	400	500	600	700	800	900	1000
0.001	1.000	0.917	0.863	0.822	0.794	0.766	0.741	0.724	0.711	0.703	0.695
0.002	1.000	0.875	0.788	0.725	0.675	0.625	0.588	0.562	0.544	0.526	0.512
0.006	1.000	0.825	0.732	0.652	0.587	0.525	0.476	0.440	0.412	0.387	0.364
	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	
0.001	0.687	0.680	0.672	0.654	0.641	0.620	0.592	0.560	0.525	0.488	
0.002	0.500	0.491	0.483	0.476	0.470	0.465	0.461	0.457	0.453	0.450	
0.006	0.352	0.340	0.328	0.317	0.306	0.296	0.287	0.278	0.270	0.262	

Professor Marx, and the results were presented in a paper read before the American Society of Mechanical Engineers in December, 1924.

These tests showed that the accuracy of the gears had a marked influence on their strength. Table III gives the velocity coefficients established from these tests, while in Fig. 26 diagrams of these same results are presented.

The form of the curve in Fig. 26 for the most accurate of the gears tested shows a downward trend at the higher speeds quite different from the other two curves. The probable cause of this is the fact that the

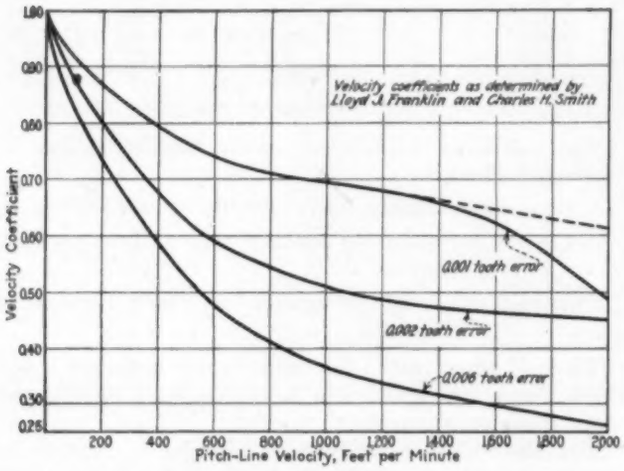


Fig. 26—Variation of velocity coefficients with magnitude of gear errors

testing machine was strained beyond its capacity in making these tests. As noted in the log of the tests, the steel driving gears on the testing machine were almost entirely destroyed under the heavy loads imposed. With stronger and more rigid testing equipment, this curve would probably have a very similar form to the others, as indicated by the dotted line. This downward trend in the first curve also indicates the possible influence of the errors in the train of driving gears on all of the results obtained. Probably all of the gears would show higher values if the drive were smoother, such as would be obtained by means of a belt drive to a pulley fastened directly on the shaft of one of the test gears. These tests indicate that the strength of gear teeth in a train of gears is less than when the gears operate as a single pair.

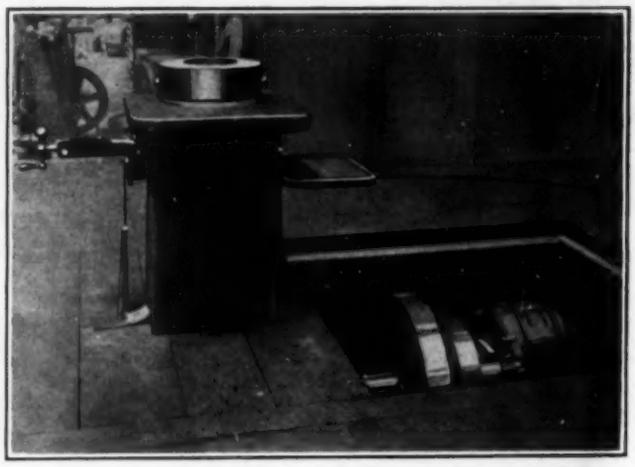
The velocity factor has always been considered as constant for any given speed, regardless of the characteristics of the material in the gear or the amount of the unit load. In the absence of any evidence to the contrary, this assumption results in simple forms of equations. All tests made to determine this velocity factor have been made by running cast-iron gears to destruction, and the velocity factors so obtained have been used for all other materials.

Tests seem to indicate that radial faces on tools do not give a true cutting action, but rather that the metal is scraped or pushed off. A top rake of 10 deg. or an equivalent undercut in a milling cutter, helps matters considerably. Combining the undercut with the proper curve at the bottom of the tooth, reduces the power required for cutting.

Keyseater Placed for Convenient Working Height

BY J. MONROE

In the *American Machinist*, Vol. 64, page 381, I read of the policy of the Morgan Construction Co. in regard to setting machine tools with tables at heights convenient for the workmen. With that article in mind I was much impressed by the arrangement of the keyseater shown in the accompanying illustration. The



Keyseater in pit

machine is a Mitts & Merrill No. 6, which will cut a 4½-in. keyway. The machine is shown as installed in the plant of the Pelton Water Wheel Co., San Francisco. The pit, walled with concrete, is 3 ft. deep.

All the work assigned to this machine is large, and for economy in time and manual labor it is very advantageous to have the table height low.

Apprenticeship at Las Vegas

BY J. MADDEN

Railroads as a whole recognize their obligations in training mechanics. At the Las Vegas, Nev., shops of the Union Pacific System, for example, there are an apprentice instructor, and a group of apprentices, with a maximum quota of twenty-four.

The boys are divided into two classes and instruction in the classroom is given two mornings each week, from 7 to 9 o'clock, making the classroom hours for each boy four per month. All the remainder of the boy's time is given over to practical work in the shop, where he is supervised closely by the apprentice instructor, and is directed by the foreman.

Instruction is given on company time, and all equipment and models are furnished by the company. At the conclusion of the apprenticeship the boy is given a diploma.

The pilots of the Western Air Express, that carries mail and passengers between Los Angeles and Salt Lake City, are on a competitive basis so far as economy of operation goes. They are not trying to break records but to put air transportation on a paying basis—and are doing it. The Liberty engines used are giving 200 hours' service between overhauls and repairs have been kept down to a minimum.

Automotive Production

Standard Machine Tools in the Willys-Overland Crankshaft Line-Up

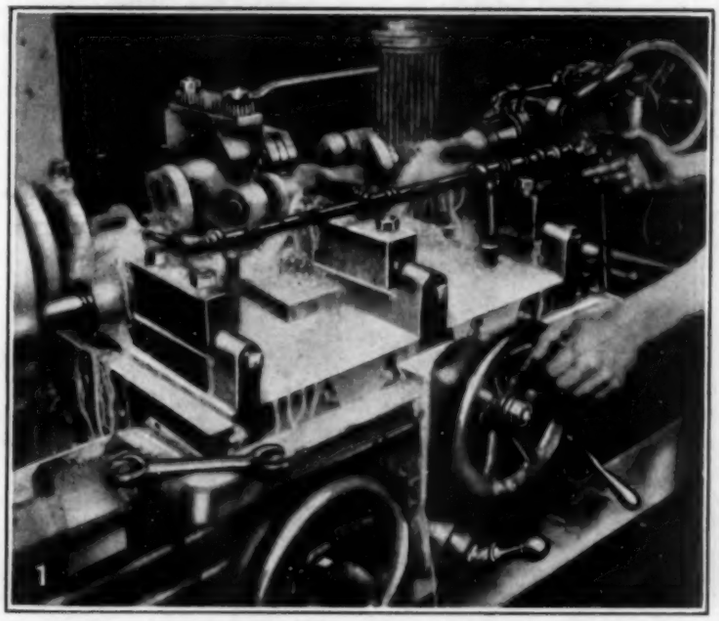
By Fred H. Colvin
Editor, *American Machinist*

Special fixtures enable standard machine tools to compete with single-purpose equipment—Crankpins ground from the rough—Straightening and cutting keyways

THE crankshaft department of the Willys-Overland Co. in Toledo, Ohio, has recently been moved into a new building and the machinery arranged for straight-line, or progressive production, in accordance with the latest practice. Beginning at one end of the building where the forgings are received, the shaft is first inspected, straightened if need be, centered and then goes to the American lathe in Fig. 1. The carriage is fitted with a special tooling block, carrying three tools. These tools are very rigidly held and rough turn the three main bearings of the shaft. The center bearing is supported by a substantial roller rest and each tool is flooded with cutting lubricant. The flange is also rough turned at the same time, and the center bearing is rough ground to aid in future operations.

After turning the small end for the gear and finish turning the flange and oil slinger, the shaft goes to the milling machine, Fig. 2, where the flange is milled to clear three of the flywheel bolts. After one clearance slot has been milled the shaft is turned so that the index pin *A* locates it for the next slot, the third slot being positioned in the same way. The clamp *B* is also unusual in having a slide *C* by which its position can be adjusted. The center bearing is clamped as at *D*.

The flange is drilled on a Rockford horizontal machine that is fitted with a special fixture for drilling and reaming the flange at the same operation. This fixture holds three shafts and is shown in Fig. 3. The fixture is loaded at the top, and indexed one-third revolution to bring the shaft in front of the drill head at *A*. At the same time, the previous shaft has reached the reaming position, so that both operations are done



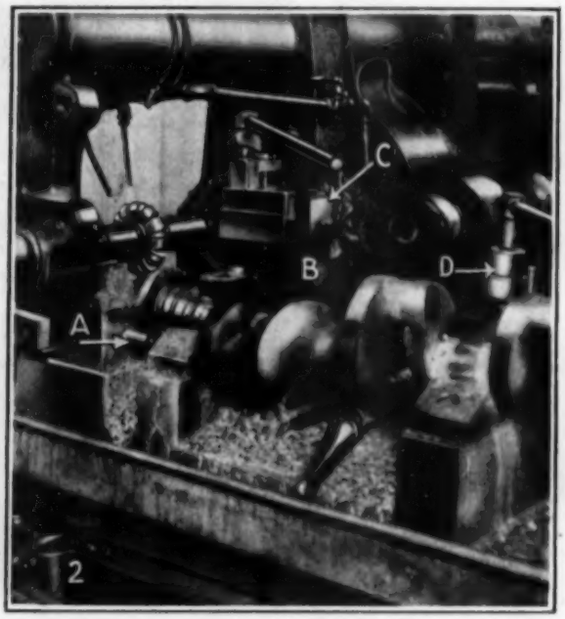
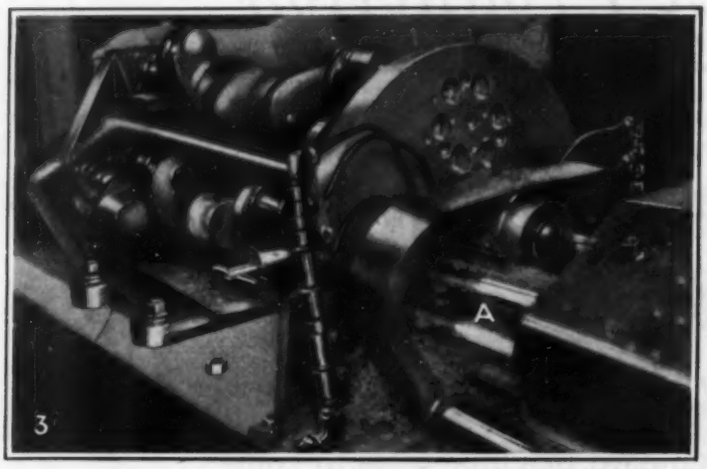
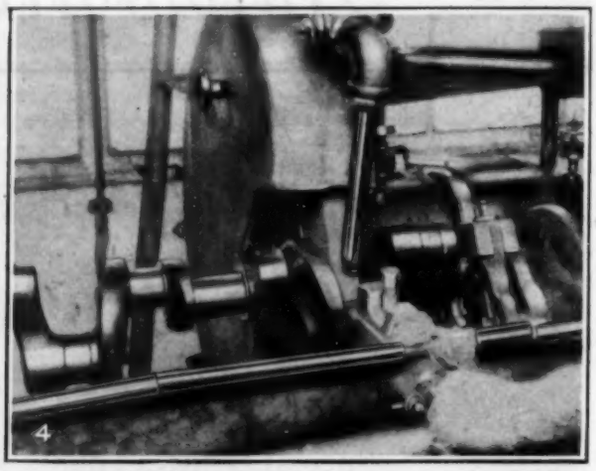
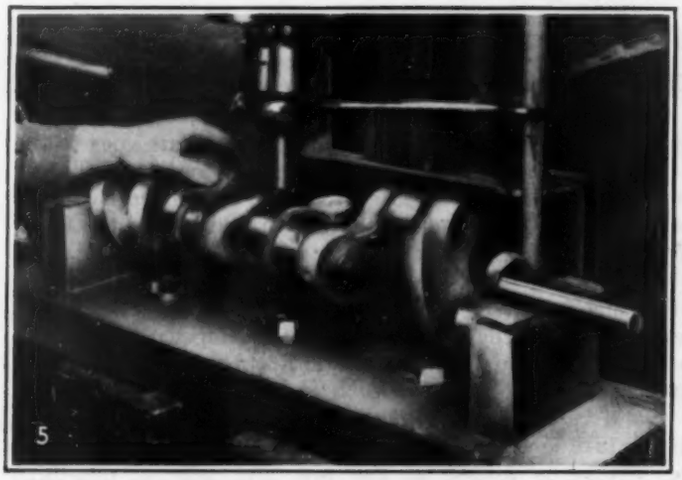


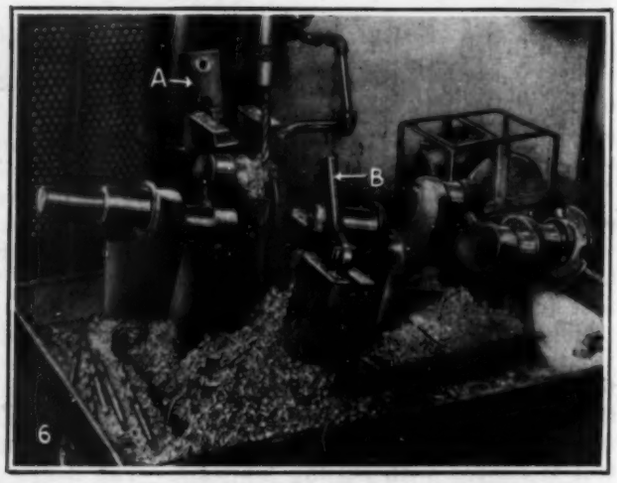
Fig. 1—Rough turning main bearings. Fig. 2—Milling flywheel bolt clearance

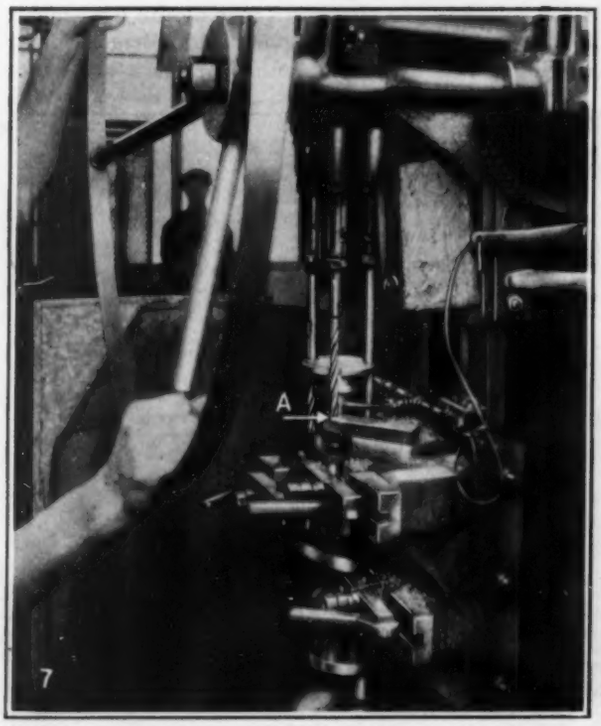
Automotive Production

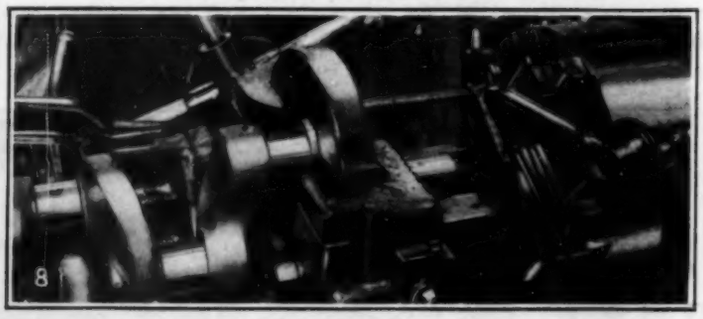












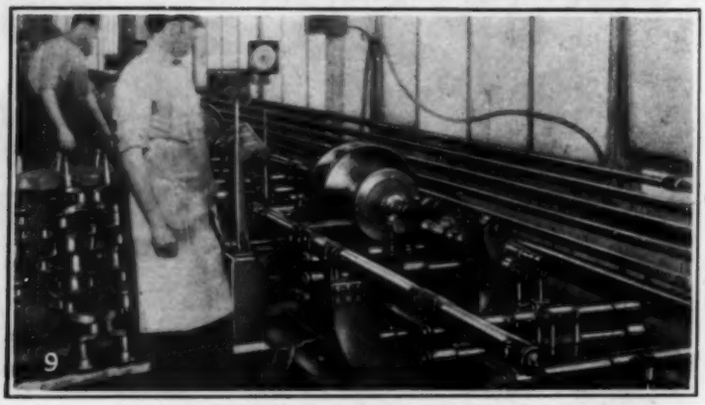


Fig. 3—Drilling fixture for flange. Fig. 4—Grinding crankpins from the rough. Fig. 5—The straightening press. Fig. 6—Drilling oil hole in cheek. Fig. 7—Crank pin drilling fixture. Fig. 8—Threading the small end. Fig. 9—Battery of balancing machines

Automotive Production

at once. The front fixture-support is designed to allow the drills and reamers to pass under it.

There are, of course, several grinding operations, the crankpin being ground from the rough, without previous turning. The wheels used are 36-0 Norton. The fixture is shown on a Norton machine in Fig. 4, which gives an idea of the clamp and of the comparative length of the main and crankpin bearings.

One of the straightening operations is shown in Fig. 5, a worm-driven screw press being used for this purpose. The shaft rests in V-blocks with the bearings protected by pads. The dial indicator at the back shows how much the shaft must be bent to bring it into a condition of proper alignment.

Since the engine depends on pressure for lubrication, the crankshaft is drilled for oil, which involves several operations. Two of these operations are shown in Figs. 6 and 7. The web or cheek is being drilled in Fig. 6 and the fixture is a good example of design for this kind of work. The shaft is held at the proper angle and the oil hole is located by the bushing in *A*, which is thrown back out of the way after the hole has been well started. The bushing support is easily locked in place by a latch, and as quickly thrown back. It will also be seen that the strap *B* is locked in place by a cam that bears in the groove to locate the strap in its proper position.

Three crankpins and one-half of the crankshaft are drilled in the fixture in Fig. 7, where two of the drills have extension shanks to carry them to the pins to be drilled. Each drill has a guide bushing just over the pin it is to drill, one of them being seen at *A*. It will also be noted that each of the three clamps used have the same type of locking lever, with the cam working in the groove or slot.

Part of the holes are tapped so as to plug the ends, after which there are a number of other operations, including another straightening. The keyway is then cut for the timing gear, the small end threaded on a Landis machine as in Fig. 8, and the shaft is ready to go to one of the battery of precision balancing machines at the end of the production line, as in Fig. 9. Here it is carefully balanced before going to the sub-assembly to receive the flywheel, on its way to the final assembly line. The care in balancing crankshafts is, perhaps, typical of the improved quality that is being built into "little six" engines, selling at prices that would have been unbelievable a few years ago.

Accidents have become more frequent and much more severe in the automotive industry since 1923. The reason, as given by W. H. Cameron, director of the National Safety Council, is lack of thought and care in safeguarding new equipment.

Traveling 27,500 miles and carrying 7,500 passengers without injury to any one, is a record that any form of transportation might well be proud of. When we learn that this was the record of the Curtiss flying service, it ought to give a lot of confidence in the reliability and safety of aviation as a means of passenger and express transportation.

Abstracts

from other publications

A Simple Works System

The shop system in use at the works of the Tilling-Stevens Motors, Ltd., is featured as of extreme simplicity, and well adapted to a plant manufacturing commercial vehicles.

When the design of a chassis is completed the parts required for the erection of the chassis are scheduled. This schedule is split up into unit sections, each of which is given a number and a letter. The number is constant and refers to one particular unit of the chassis. The letter denotes the type of unit when more than one design is in existence.

The schedule sheets are issued to the purchase, progress, planning, and rate-fixing departments. The purchase and the progress departments then use these schedules for buying and for manufacturing the required number of units. Maximum and minimum stock figures are fixed for all raw materials and for components bought finished.

The progress department reviews the position monthly, and issues to the machine shops the requisite number of components for machining. A shop order accompanies the material requisition. A daily return is made from stores to the progress department of all material issued. For purposes of comparison the year is split up into thirteen four-weekly periods.

Clock cards are used for the operations, and the information is transferred to the cost sheet by the clock clerk. When work is passed by the inspectors the clock card is signed by the inspection department. These clock cards originate in the rate-fixing department, where piece-work times allowed are entered in a space provided.

A unit assembly order is issued to the foreman on the commencement of a job. This card is kept at the clock station, and a record is made on it of the workmen employed on each part.—J. T. KENWORTHY, in *The Automobile Engineer*, Sept., 1926, p. 343.

Progress in Air Transportation

Because Europe has developed more commercial air transportation than this country we are under the impression that European airplanes are superior to ours. This, however, is not the case. America has developed planes that for reliability, safety, and carrying capacity, equal the best that Europe has produced. We have maintained services between such centers as Detroit and Chicago, and Detroit and Cleveland for over a year; making one or more round trips every day on regular schedules, with planes capable of carrying ten passengers with baggage, or an equal amount of freight, without a single mishap.

Furthermore, these planes have maintained their schedules in winter and summer during all kinds of weather—wind, rain, sleet and snow—proving that the usual elements are no obstacle to the regular com-

Automotive Production

mercial transportation of passengers and freight. During the past year there have been but eight days when the planes did not leave Detroit on their regular schedule. On one of these days of intense fog not a single ship passed through the Detroit river in eighteen hours—usually so busy a place of navigation that a ship passes through it every five minutes.—William B. Stout, in *Machinery*, September, p. 1.

Reliability in Air Service

On July 6, 1926, the Philadelphia Rapid Transit Air Service, Inc., began carrying passengers between Philadelphia and Washington, D. C., using one plane. A second plane was put in service on July 16 and on Sept. 15 a third plane was used to extend the service to Norfolk, Va. Fokker planes are used. Up to date the service has been 97 per cent efficient, and no forced landings due to engine trouble have been made. Seven trips have been cancelled due to bad weather and four abandoned after returning to the airport, while three landings were made, all due to the same cause. With a total of 259,140 passenger miles flown, great reliability of air travel is shown.—*Aviation*, Oct. 25, 1926, p. 705.

"Roloid" Pump Gears

A modified form of tooth profile has been developed by David Brown & Sons (Huddersfield) Limited, Lockwood, Huddersfield, England, for use in the gear pump. The profile is registered under the name of "Roloid." It is said that the generating process results in reduced sliding and increased rolling action between the teeth. Furthermore, interference and undercutting have been eliminated so that a pair of gears with only seven teeth will mesh correctly without any modification in the form being necessary.

In the design of this tooth form, particular attention was directed toward the attainment of maximum efficiency in pumping and the avoidance of unnecessary losses through trapping the fluid between the engaging teeth. Both these effects were accomplished by limiting the overlap of tooth contact so that the interval during which fluid is trapped between the teeth is almost negligible. Contrary to usual practice ample backlash is required; if the forms are correctly developed no loss in delivery results from this cause. Pumps designed to handle gases, however, should have minimum backlash and clearance.

A comparison between a pair of 8-tooth gears of the Roloid system and the standard 14½-deg. involute is made in Figs. 1 and 2 respectively. As can be seen, the standard involute form is subject to severe undercutting when the number of teeth is small. With an increase in pressure angle the undercutting is reduced, but the depth of the tooth is correspondingly reduced, and, for pump work, no great increase in delivery is obtained. With the Roloid tooth form, it is claimed that the number of teeth can be kept at a minimum without undercutting, while a maximum depth of tooth is maintained together with high delivery capacity.

In Figs. 1 and 2, the tooth profiles are marked off by alternate black and white bands that represent the

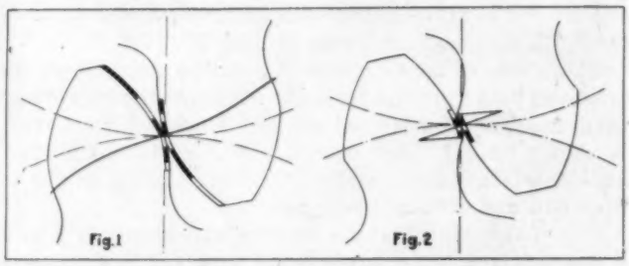


Fig. 1—A pair of "Roloid" profiles on 8-tooth gears. Fig. 2—A pair of 8-tooth gears with 14½-deg. involute profiles

motion of the point of contact over the tooth profile in equal intervals of time. The longer these bands, the greater is the area of tooth surface usefully employed. The figures indicate that the wearing surface of a Roloid toth profile is about four times that of a standard involute profile.

The standard proportions adopted for Roloid teeth are similar to recognized standard involute teeth, except that the clearance is increased slightly.

$$\text{Addendum} = \frac{1}{\text{diametral pitch}}$$

$$\text{Dedendum} = \frac{1.2}{\text{diametral pitch}}$$

These tooth proportions result in the following gear dimensions:

$$\text{Pitch diameter} = \frac{\text{number of teeth}}{\text{diametral pitch}}$$

$$\text{Outside diameter} = \frac{\text{number of teeth} - 2}{\text{diametral pitch}}$$

$$\text{Root diameter} = \frac{\text{number of teeth} - 2.4}{\text{diametral pitch}}$$

The delivery capacity of a pump made with Roloid gears may be calculated as follows:

$$\text{Delivery, cu.in. per min.} = KC^2FN$$

where C = center distance, in.
F = face of gears, in.
N = r.p.m.
K = delivery coefficient, a function of the number of teeth. The relation of K to the number of teeth is given as follows:

No. of teeth	7	8	9	10	11	12
K	0.96	0.84	0.73	0.66	0.59	0.53

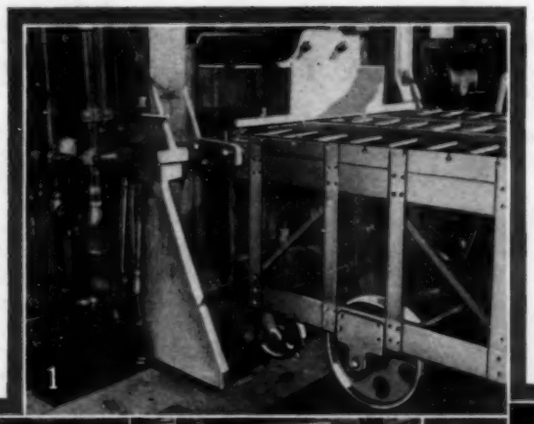
The calculated delivery must be multiplied by the volumetric efficiency, which ranges from 75 to 95 per cent, depending upon the accuracy of the workmanship, the speed of rotation, and the characteristics of the fluid being pumped.

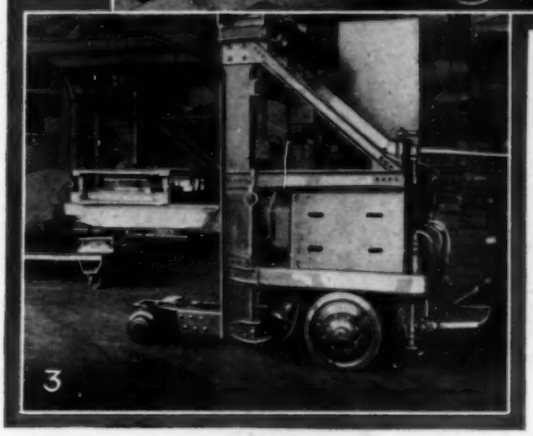
Roloid gears are regularly made in standard diametral pitches as follows: 8, 6, 5, 4, 3, 2½, 2, 1½, 1¼, 1. These pitches should be adhered to where possible.

Piston rings should have from 0.001 to 0.0015 in. clearance in the groove. The gap between the ends can be 0.005 in. on a 3-in. ring with a 45-deg. cut.

Practical Ideas *from a* Pressroom

Photographs by courtesy of the National Cash Register Co., Dayton, Ohio





In mounting heavy dies, the truck shown in Fig. 1 is used. The truck has rollers on its top face so that the die can be shifted easily on to the bolster plate.

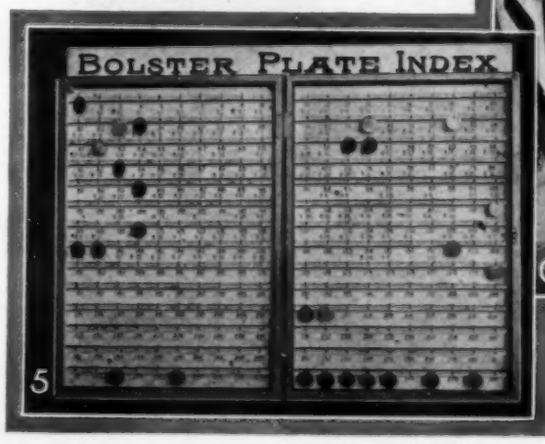
To eliminate the necessity of having a bolster plate for each press tool, one bolster plate is used for a group of dies. Each plate is numbered and stored in a rack, such as shown in Fig. 2, that bears a corresponding symbol.

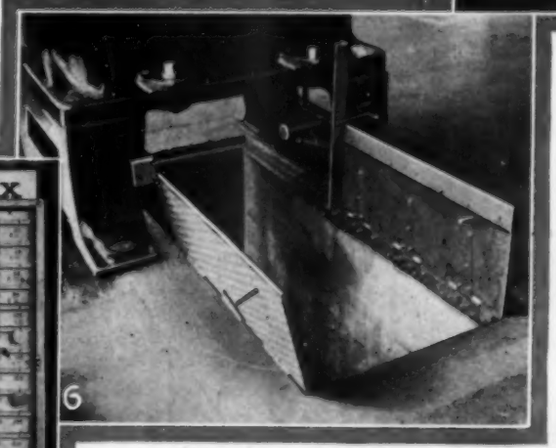
Dies are transported throughout the department by trucks as shown in Fig. 3. The platform of the truck is elevated to the height of the bolster plate or bed of the press. A record is kept of the location of all dies.

When a die is to be stored, it is transported by truck to the table illustrated at the left in Fig. 4. From here it is shifted to the elevating truck shown and placed in the storage rack.

The index board illustrated in Fig. 5 indicates the location of bolster plates. When a bolster plate is removed from its rack, a tag, marked with the number of the press to which it goes, is hung on the corresponding number on the index.

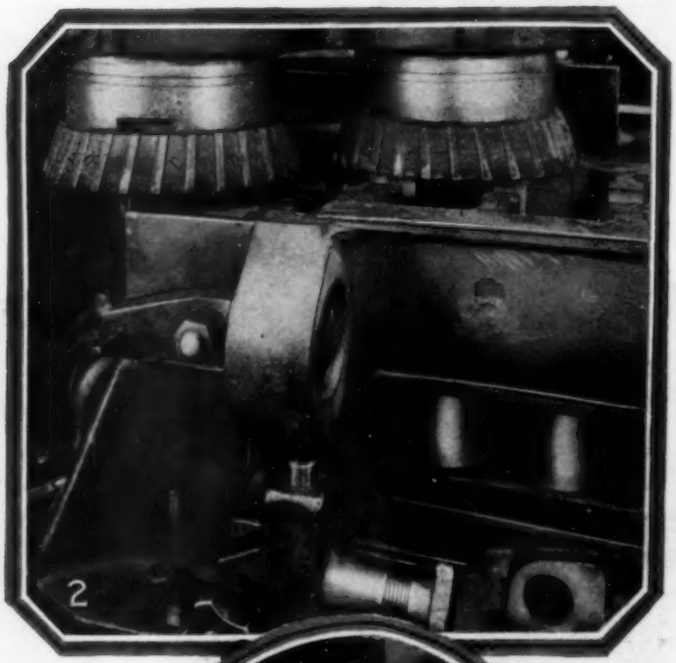
Presses that handle large dies are mounted on a foundation as illustrated in Fig. 6. The pit under the press is 5½ ft. in depth and 2½ ft. in width. It has six steps so that an operator can enter it to adjust spring pads and to tighten bolster-plate bolts. When the pit is not in use the opening is covered by two iron doors.



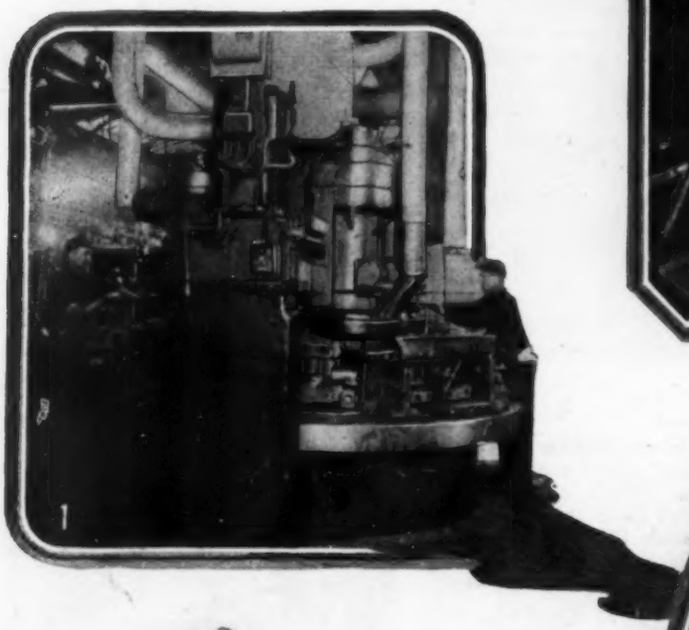


Cylinder Operations

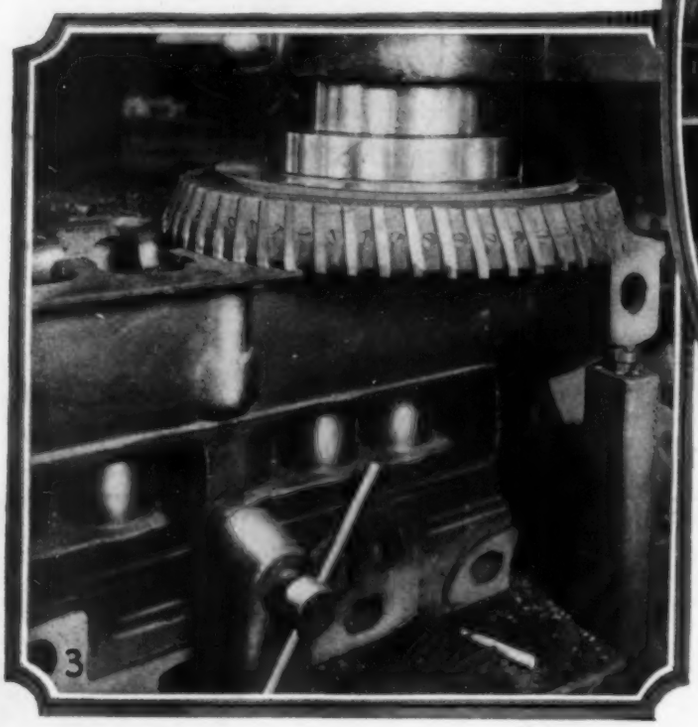
2—The two roughing cutters



1—Milling tops and bottoms on rotary machine

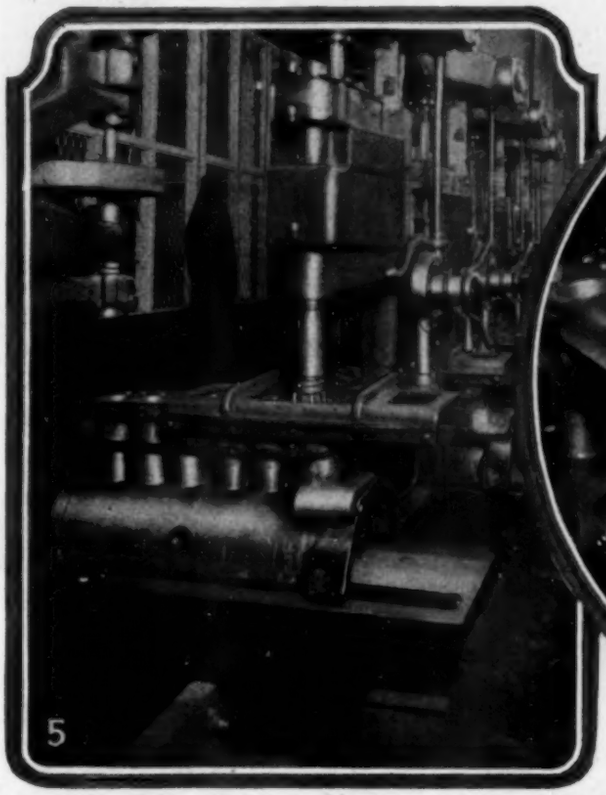


3—Finishing with a large, single cutter

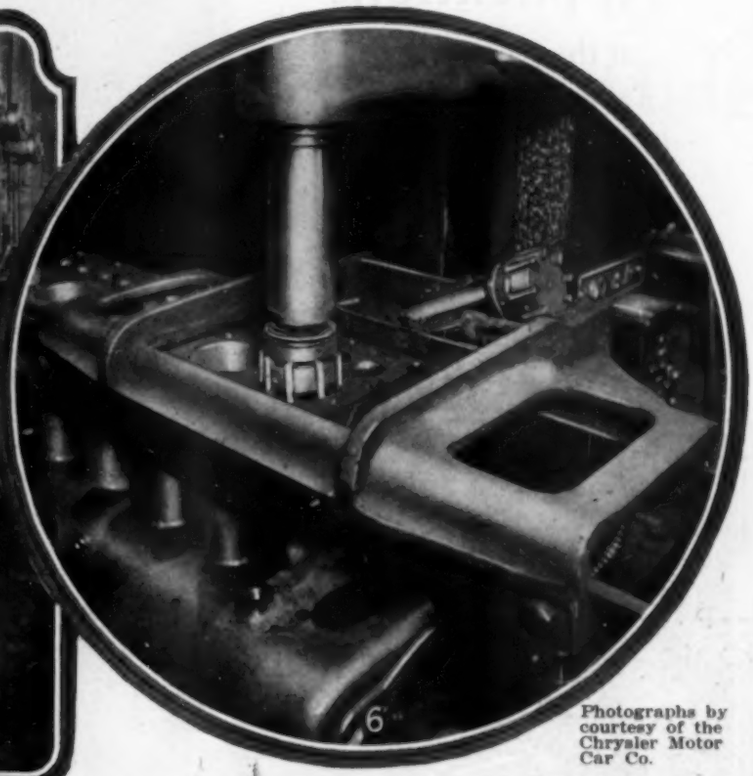


4—Countersinking stud holes

in the Chrysler Shop

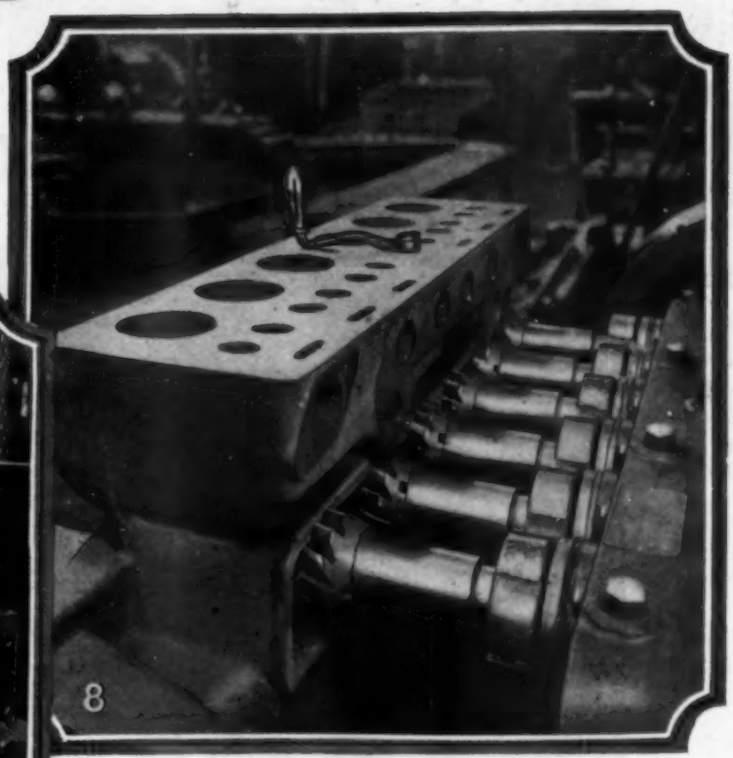


5—*Reaming one bore at a time*



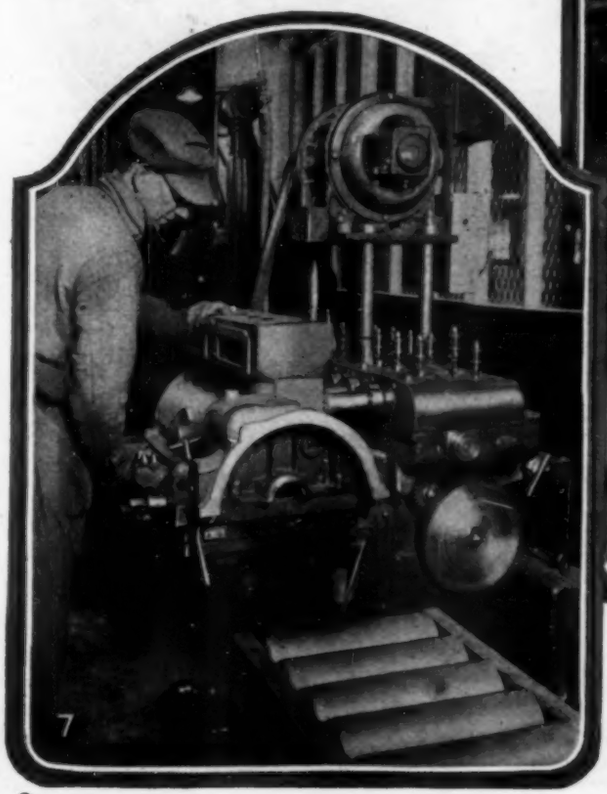
Photographs by courtesy of the Chrysler Motor Car Co.

6—*Close-up view of fixture*



8—*The six cutters at work*

7—*Milling for valve-opening covers*



Four Air Applications

at the Sayre Shops Lehigh Valley R.R.

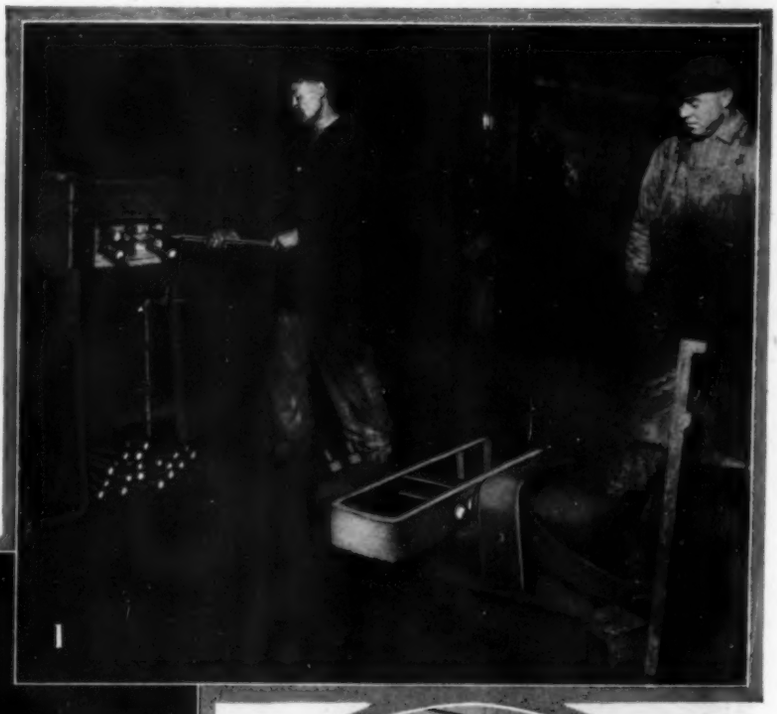
1—Plant for riveting car-coupler yokes —Oil furnace and air-operated rivet press

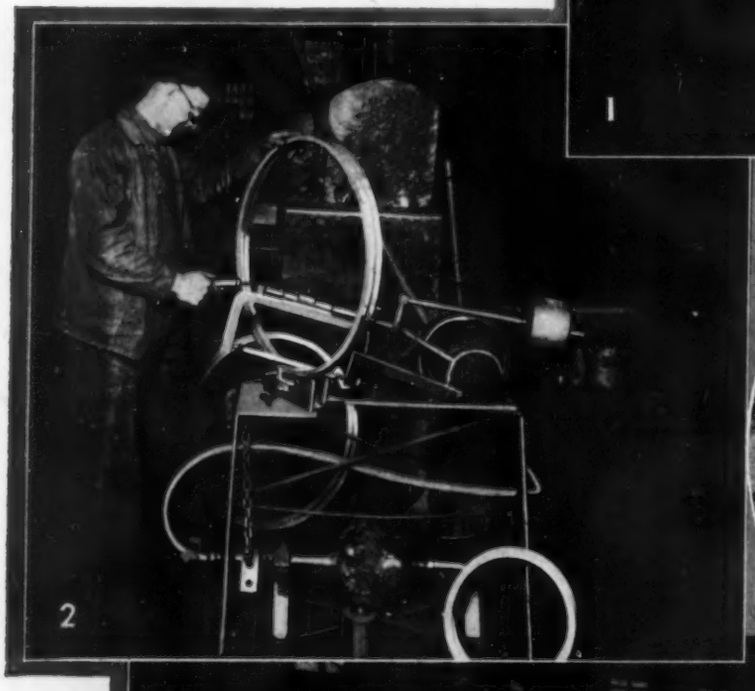
2—Hacksaw for sawing piston rings —Driven by air motor

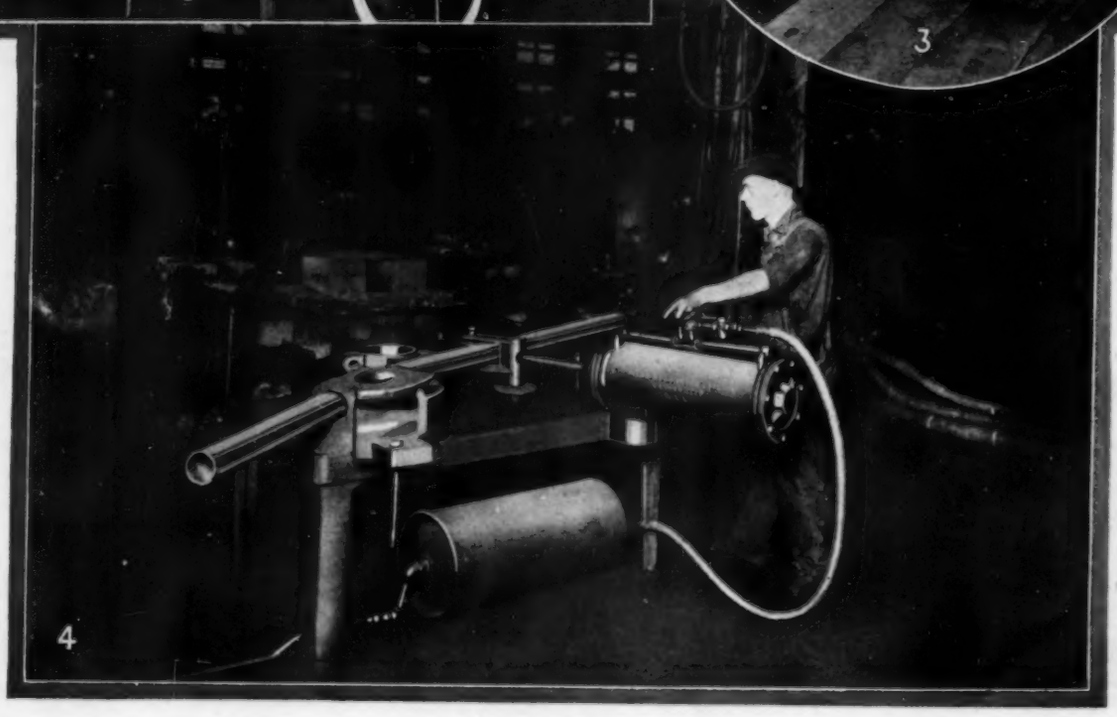
3—Shearing rivets in car-coupler yokes

4—Air-operated pipe bender

Photographs by courtesy of the Ingersoll-Rand Co.







Electric Seam Welding Applied to Sheet-Metal Work

By Frank W. Curtis
Western Editor, *American Machinist*

Principles of the seam-welding machine and procedure to follow in welding different types of work—Examples of welding operations—Importance of cleaning—Knurling rolls for scaling

ELECTRIC seam welding of sheet-metal parts, in such shapes as tanks, cans and containers, is handled much after the order of sewing in that the overlapping seams are joined together as they pass a means of connection. In brief, the process consists of a series of spot welds delivered to the work as it passes a point of contact. Automobile fenders and body sections, likewise, are assembled by the process, thus insuring a solid, leak-proof joint, and, in many cases, simplifying their manufacture. The information shown, obtained from the Gibb Welding Machines Co., Bay City, Mich., illustrates the principles employed in seam welding, and shows examples of parts that can be welded by the process. A diagram showing the principle of the machine is shown in Fig. 1. The secondary connection of a transformer, that is mounted on the base of the machine, is connected to the upper and lower welding arms. Interruption of the current is accomplished by an eccentric that is driven by a small motor. The upper welding wheel is driven by the same motor and the lower welding wheel is an idler. Work to be welded is placed on the lower wheel, after which the upper roll is lowered to the position shown. At *A* may be seen the relation of the work and the rolls when they are in a welding position. The purpose of the interrupted current is to insure a uniform heat throughout the duration of the weld and to guard against overheating of the rolls. Water cooling is provided in both rolls to avoid excessive heat.

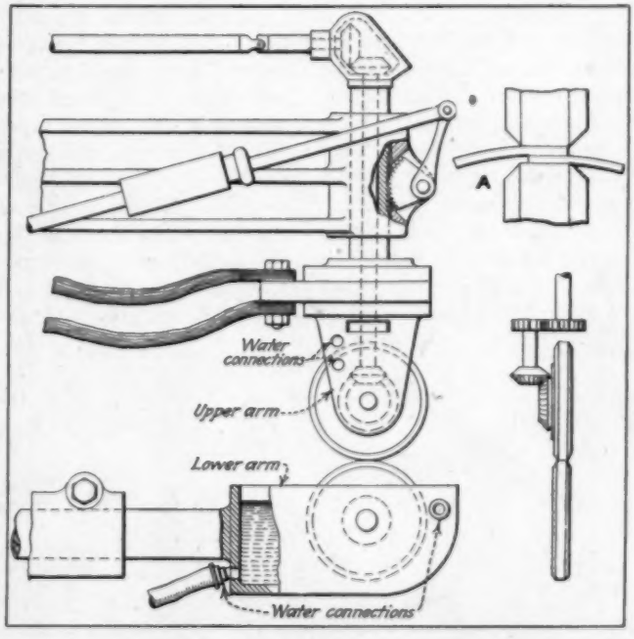
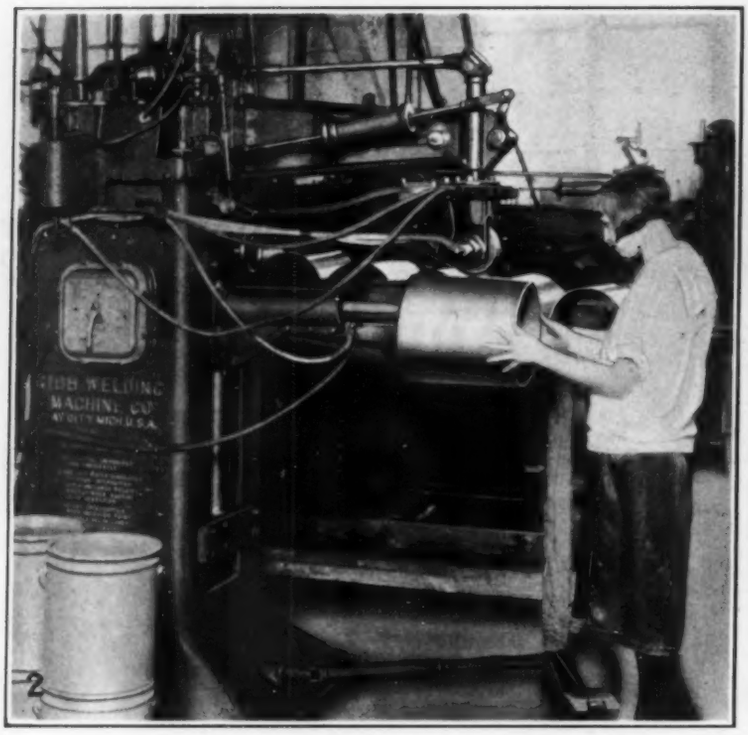


Fig. 1—Principles used in seam welding

The process is applicable to tinware and sheet steel ranging in thickness to 14 gage. The welding length range is 3 ft. These lengths can be doubled by reversing the work after one end has been completed. Speeds up to 60 ft. per min. with 60-cycle current, in accordance to the thickness of the metal being welded, are used. The governing points to consider in seam welding are the speed of the work, and the heat and the squeeze at which the weld is made. Both of these calculations are determined by test. In Fig. 2 is illustrated a seam-welding operation in the making of cans. The metal is 20-gage sheet steel and the speed applied is 108 in. per min. By turning the upper head one-quarter turn, and applying a lower arm to correspond, the bottom section of the can is welded to the body. An example of this kind is shown in Fig. 3 in which the machine is arranged for welding exhaust manifolds that consist of nine cup-shaped sections and require eight welds. The lower mandrel is water-cooled, similar to the upper arm, since a reservoir, such as shown in Fig. 1, cannot be used. In making cans and tanks similar to that shown at *A* in Fig. 4, the body first is welded at *B*, after which



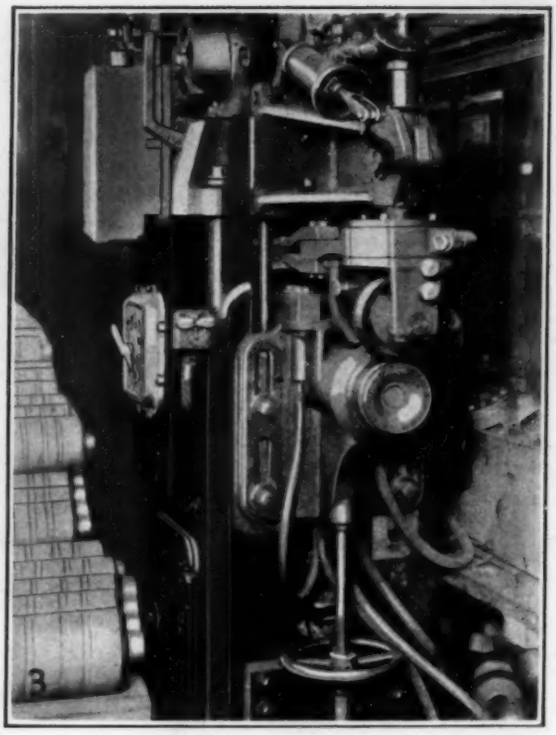


Fig. 2—Seam welding a can body. Fig. 3—Welding rolls arranged for end welds

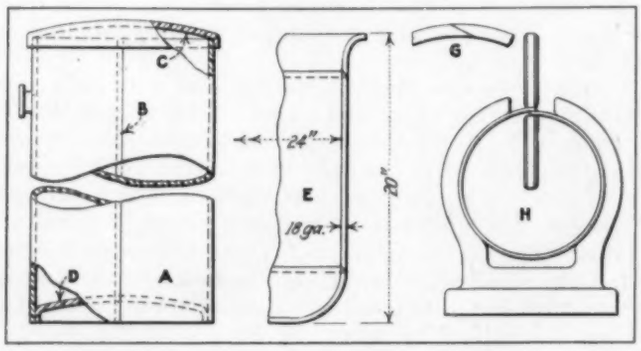


Fig. 4—Details of seam-welded work

the rolls are reversed so that the end piece *C* can be assembled. This joint is made by placing the tank body over the lower roll. A similar end piece cannot be applied on the opposite end since the tank is closed; therefore, the end shown at *D* is applied. This design permits the lower welding roll to enter the recessed portion of the end piece. When a smooth surface is required, scarfing, such as shown at *E*, is used. At *G* is shown the same principle applied to cylindrically shaped work. If a narrow seam is to be made, a fixture similar to the one outlined at *H* can be applied. The same method is used on other work requiring an accurate diameter.

One factor essential in seam welding is to have a clean surface on the portions of the work to be joined. Sheet metal usually contains a scale that is detrimental in welding; therefore, this scale must be removed often. A wire brush is used for this purpose but unless sufficient pressure is applied the surface is not thoroughly cleaned. Grinding can be used, although there are two points to consider; one is to guard against the variation in the thickness of the work after snagging, which would cause an uneven pressure when the work passes the rolls, and the other is the burning of the metal. A burned section will not weld properly. Knurling, for which patents have been applied for, is used to advantage, and in Fig. 5 are illustrated details of the operation. The work *A* passes between knurling rolls that are set to a given pressure. The grooves of the rolls are cut opposite each other and the work is marked as shown at *B*. When the work is reversed and again passed through the rolls, the surface is marked as shown at *C*. The scale is removed readily by this method. By using two sets of rolls as shown at *D*, the operation can be simplified. Another method employed, illustrated at *E*, utilizes two sets of rolls that are arranged in line so that the work passes from one set to the other, completing the knurl on both sides in one

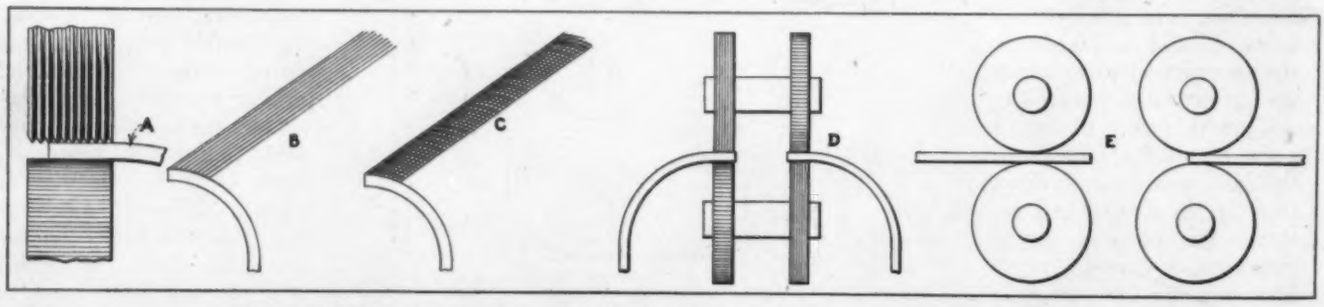
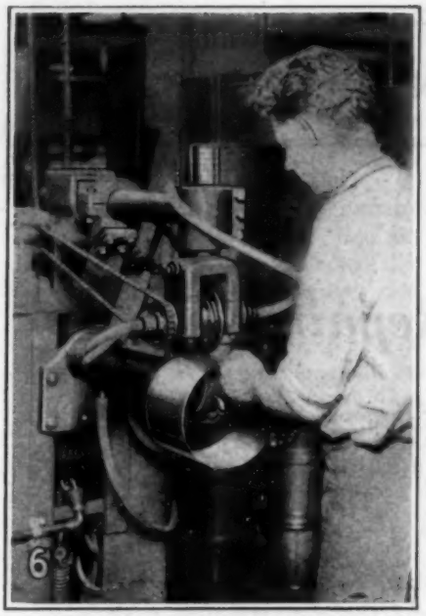
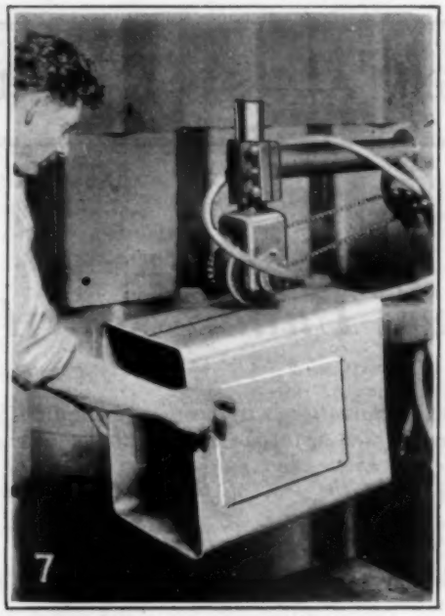


Fig. 5—Knurling rolls applied in cleaning surfaces of work to be welded





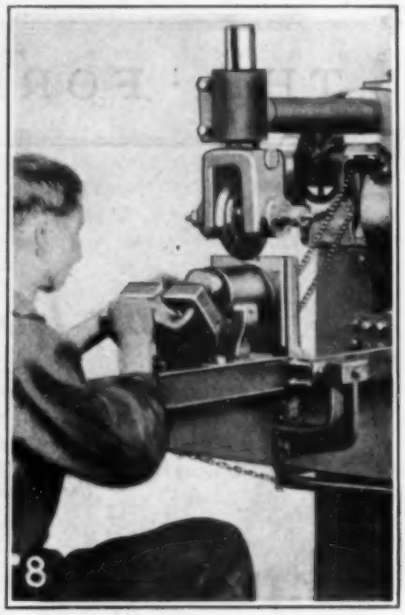


Fig. 6—Welding a small sheet-metal container. Fig. 7—Joining two halves of an oven. Fig. 8—Sliding fixture applied in seam welding

pass. In all cases, the upper rolls are driven and the lower rolls are idlers.

In Fig. 6 is illustrated a seaming operation in which the upper roll is driven by a chain. The metal is 20-gage and a speed of 9 ft. per min. is applied. A similar machine is shown in Fig. 7, seam welding ovens. The ovens are made in two sections and are welded as shown. The metal is 18-gage and a speed of 8 ft. per min. is used. Fig. 8 illustrates an operation requiring the use of a fixture in which the work rests on an arbor instead of an idler roll. The ends of the work are embedded in the grooves of the upright plate and the swinging end piece that the operator is shown adjusting. The fixture, mounted on slides, is chain driven and is operated at a speed of 8 ft. per min. The metal is 22-gage. In cases where the outlined method of water cooling is difficult due to the size of the work, the work piece can be placed on an arbor and welded while it is entirely submerged in water.

The headpiece illustrates a variety of seam-welded parts. Among this group may be seen such units as tanks, table legs, stove parts, ice-cream cans, tea kettles, mufflers, car heaters, and reflectors.

Costly Education

BY ENTROPY

There seems to be something about dog days that leads to speculation. Jim brought this to my mind today. He told about the young tech fellow that is his engineering department, or would be if Jim would let him engineer anything. It seems the boy was bragging about how much his education had cost, and how he expected to get the money back from his employers as time went by. Sort of created the notion that an engineering education costs a lot, and therefore must be worth what it costs. Apparently Jim stood it as long as he could, and then started bragging a bit himself.

"Do you know," he said, "how much it cost me to learn that momentum is something worth remembering? Well it cost upwards of five thousand. I took the job of building a special machine that had to have heavy reciprocating parts, and I just designed it so I was sure it was strong enough, but I didn't make it strong enough to stand the stresses it set up in itself when it shifted direction too rapidly.

"Then there was the time I was shipping a lot of stuff abroad. It cost me several thousand dollars to learn how to box it so it would go through, and it cost quite a little more than a year's income to learn what was the cheapest way to ship."

Jim was all wound up, and he went on and recited things that he had learned from experience, costly in varying degrees, but I had to disagree with him when he drew the conclusion that it was useless to pay for an education in school when afterwards education by experience was bound to cost so much.

My conclusion from his talk was that Jim had failed to study his jobs beforehand, and had neglected the most ordinary reading that it is presumed a business man and an engineer does. His high cost of learning about momentum came from his top-lofty assumption that he knew all about designing machinery, and didn't need to ask anyone or read any books before he began to design. There was also plenty of literature about boxing machinery, and the woods are full of freight solicitors who would have told him the advantages of shipping by various lines.

Experience runs a very expensive school, but in these days of technical books, magazines and papers it seems inexcusable for men to make expensive mistakes merely because they are too proud and conceited to acknowledge that their knowledge of their business needs occasional polishing off.

The Japanese government is to promote commercial aviation by building airdromes and supplying such aids to navigation as may be necessary. The transportation must, however, be done by private companies, mail routes being part of the plan if found feasible. It is undecided as to just how the government will extend aid to these specific projects.

THE · FOREMAN'S · ROUND · TABLE

Cutting Down Unnecessary Repair Costs

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"THE machine shop ain't what it used to be, Al," was the commonplace remark of Ed as they sat at the lunch counter.

"What's on your mind, Ed?"

"Lots of things, Al. Mostly the damnfool carelessness that broke down the big boring machine this morning. Bill Jones left his big wrench on the table and started up the machine. Wrench jammed on the housing, smashed part of the casting in the chuck, and that got tangled up with the side head before he could stop it. Just pure, plain, dumb carelessness and it ties up the machine for a week at least. And Williams hollering for that work to beat the band."

"What you going to do, Ed?"

"Oh, I've planned to do the job on that big, old turret lathe that came out of the ark. Glad we didn't scrap it, now, though it's been a darn nuisance lots of times. But I can't make any time on the job and I've got to put a high priced man on it. What gets me, though, Al, is to find some way to stop such damn carelessness."

"It's quite a job, Ed. And even the best of us do a fool trick once in a while. There's one shop I heard of, though, that claims to have cut down careless mistakes a lot."

"What's the plan, Al?"

"This shop runs the departments with a group bonus. The cost of every breakdown due to carelessness comes out of that bonus. The less expense there is in keeping up machines in that department, the bigger the bonus.

"It works this way in a group of workmen. When they see how the careless man cuts into their bonus they jump on his neck and keep him up to the mark. If he keeps on being careless they make it so unpleasant he gets out. Seems to me the plan has good points. Only we couldn't use it yet."

"Why not, Al?"

"Caught you there, Ed. Can't work it without having a bonus or something to penalize. Can't very well dock men from their regular wage without getting tangled up with the lounger. But if it's an extra boost—that's different."

"Sounds good to me, Al. Wonder if we can sell the idea to Williams?"

"Don't believe we can, yet. Got to sell Williams on the bonus idea first on its own merits. If we don't he'll say we want to give the men something so we can take it away again if they don't play the game. But for a bonus shop, it sounds good to me."

Is the bonus penalty a good way to check carelessness? Is there any other good plan? Does firing the man help much? As both Al and Ed seem to agree on this, how can they sell the idea to Williams?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussions of Earlier Topics

Picking Assistants

EVERY foreman, to be called a successful foreman, must have at least one understudy to fill his shoes in his absence, whether for one day or for an indefinite period. Any foreman who really has the company's interest at heart would surely not be afraid to coach some man in his charge to become his assistant and to eventually step into his job. Any foreman who is afraid to break in an assistant must be considered as having a troubled conscience.

It is very bad policy to choose a man because he belongs to the same lodge, church, or because he is a relative. The men in the shop immediately resent this and take the attitude that if you are not a friend of the boss you will not get anywhere. I should want to observe the candidates for the job of assistant foreman, for a period of at least six months, without their knowing that I was planning to promote any of them.

The candidate must have ambition and the ability to get along with his co-workers. If he can gain the confidence of the workers he will be in a better position to know their attitude toward their jobs and the general spirit of the men. He must also have initiative, the faculty of knowing what to do next without having to be told. The only record that I should keep would serve as a check on his tardiness and absence, his mistakes and some of the outstanding things that he has done. His reasons for being late or absent should be jotted down.—EDGAR DOOGAN, *Designer.*

Keeping Machines on the Job

IN REFERENCE to keeping machines on the job I should like to give particulars of two methods which were adopted by two different men on the same machines and the same work in a large engineering shop.

The name of the first man was Frank. He operated seven automatics used in the making of studs, bolts, nuts and other small articles. A boy whose chief job was the feeding of the rods in the machine and the collecting of the finished parts, assisted him. Frank's method was always to keep the machines going all the time when they were working normally. If a machine was broken down he would even slight it in order to keep the other machines running.

Now Frank was superseded by a man named Jack. Jack introduced the new system of doing one job at a time and letting all the others go west. The result was that when a machine required resetting for a new job, or adjusting, the other machines were allowed to run their stocks out and were then stopped until he had finished his adjustments. The result was that frequently all seven machines were standing idle and the production was reduced nearly fifty per cent.

Needless to say that Frank was recalled to restore production to its former level.—H. MAPLETHORPE, *England.*

Picking Assistants

I WONDER if Ed's "boss" would send the office boy out to get "some kind of cigars just for a smoke," or tell his book-keeper to "order him a car, something with six or eight cylinders that will do twenty to the gallon." Yet he seems about as foolish in what he is asking Ed to do.

Does he hire an extra file clerk when he loses a letter, or an extra salesman when he loses an order and an extra foreman when his regular foreman loses a day on his schedule? And then would he fire them again when he loses a few ciphers from his bank balance?

Ed knows. No wonder he is worried. He knows what the boss will say when he reports that "Jim will take the job if we make it worth while" or that "Billy won't take it if he still has to run a machine." Al is able to run his department with sufficient momentum for it to carry over any emergency with any hand on the steering wheel, but Ed isn't or this subject would never have started.

But let us suppose an assistant will help him. Sometimes they do. What must he look for and where?

Loyalty—The willingness to try out another's idea even though he thinks the idea is wrong and that his own is better.

Ability and experience—The quality of the work must not be lowered.

Initiative—He must do his work without being told what to do and he must do it correctly.

Executive ability—Can he get a lift from his fellow workers without a written order from the boss?

Stamina—Has he the backbone to carry the load and not flinch? Has he sand enough not to slip when they are trying to put the skids under him?

Clean living—Ed can't afford to have anyone in the executive family of whom he is ashamed.—ROBERT B. MCLAUGHLIN.

Picking Assistants

THOSE chosen to serve as understudies to foremen and executives should be drawn from the ranks and should be selected, naturally, on account of their previous records. As with most rules there are occasions

THE · NEXT · TOPIC

Cutting Down Spoiled Work

QUESTIONS

Are there common, typical causes of spoiled work?

In what ways can the inspection department co-operate on acceptance standards?

What is the best way to present the spoiled-work problem to employees?

THE · FOREMAN'S · ROUND · TABLE

when it is necessary to make an exception especially if there is some outside man who is outstanding in the department in which an assistant is needed.

Desirable as it is to have an understudy, it is better not to have one than to put one in this position, who is not qualified for the job. Keep records, and when finding the averages upon which to base the decisions, be guided principally by the man's knowledge of the work and his ability to impart that knowledge to others in an effective way. Give careful consideration to his personality but don't be influenced by personal incidents.

It is desirable to give the understudy a chance to assume the responsibility for the department once in a while, not only to give him experience for emergency service, but also to ascertain whether he is really the right man for the job.—JOHN MARK MAY.

Picking Assistants

THE man whom I choose for my assistant will not necessarily be my best workman but he will be respected by his fellows, conscientious, clean living, having an opinion of his own and the ability to express it, having initiative, and having common sense as well as the ability to use it. If there are two men who are alike in these characteristics, I should choose the one who has been with the company for the longest period. One good guide as to the capability of the workman is the amount of the foreman's time that he uses up. A poor workman will need the attention of the foreman considerably more than will a good man.

New blood chosen from the outside will undoubtedly bring new ideas and methods. There are instances where the introduction of two or three new officials from the outside has completely converted a stagnant plant into a rejuvenated and profitable concern. There is no hard and fast rule, however.

When a man is made assistant foreman, notice should be posted in some prominent place in the shop. If the right man has been given the position it will not be necessary for the foreman to alter his usual routine. The only difference will be that he will have more time to attend to the important parts of his job. The assistant will gradually assume all the minor details. When the foreman is away, he will then be in a position to assume the responsibility.—ARTHUR SILVESTER.

Picking Assistants

IN MY twenty years as a "boss," I have never picked an assistant. Instead I have left it to my men to do their picking up to the time I needed one. If a man seemed to pick himself for promotion I kept my eye on him and tried the development process. I always told my men all that I knew and still managed to keep the necessary jump ahead. As a result, if I was absent for some reason or other, my department didn't suffer.

I made my men set up their own work and for that reason I had a better bunch of piece workers than most men. I had more time for inspection and helpful instruction than if I let the men stand around and watch me do the work. As a result I have a better position now and one of my men has my old job and he is doing well.

Whenever I see an advertisement for a foreman I think that there is something wrong. The fault may be that of the management for going outside of the shop for foremen, or it may be the fault of the previous foreman who had no man ready to be his successor. My department ran better if I let go a man who did not have the stuff in him. It is cheaper in the end to break in a new man than to try to make a mechanic out of a machine.

If a foreman is afraid that his assistant will take his job away from him, he had better get out before it is taken from him because he is not big enough for the job. Many a foreman has lost his position because of his inefficiency in not providing a good substitute and thereby upsetting the daily routine of the department during his absence.—CHRISTOPHER TERMEER, *Foreman.*

Picking Assistants

THE picking of assistants depends entirely on the kind of shop and the work the foreman has to do. I prefer to pick the assistants from within the shop. The hope for advancement is a good incentive to keep the men steady.

The man selected must not only be a good machinist but he must also have the ability to handle men, and be able to command their respect. As there are very few shops without men of different nationalities the foreman must possess the art of bringing them together and making them understand their jobs.

A foreman should not, if he can help it, choose a relative to be his assistant. To show partiality will only dull the ambition of the other men in the shop. The man should not be told that he is a candidate until his appointment meets with the approval of every one concerned.—GEORGE KIRCHEIS, *Foreman.*

Just What Is Discipline?

WHILE no right-thinking superintendent wants to be a slave driver, there is no room in the shop for the pest who wants to do things his way regardless of methods or routine, or for those who persist in horseplay or loitering. Al is right in being worried over this fooling. While it is not necessary to be strict outside of working hours, Ed's policy of being near-sighted is apt to be more harmful than beneficial.

About the only way to stop this practice of fooling is to educate the men by talks on safety and by displaying posters showing the results of some accidents caused in this way. It might be effective to display posters giving the court decisions in some of the compensation cases brought about by accidents of this kind, in which the decision was against the employee who was responsible

THE · FOREMAN'S · ROUND · TABLE

for the accident. Those who still persist in fooling had better be discharged than allowed to break up the discipline of the shop.

"No Smoking" signs should mean what they say for everyone, including officers and visitors. It would be quite a hard job to convince the workman who is caught stealing a smoke that the butt of his cigarette is more dangerous than the butt thrown away by officers and visitors, so the easier course of enforcing the rule absolutely, is the better policy.—THOMAS M. GARRY, *Foreman.*

Letting a Man Try His Own Way

ED IS WRONG in making a man do a job the way it was done before. No one is infallible and there is no finality in engineering. There is no job that any one man can do but what another man can be found to do the same job better or in a better way. The object of the foreman should be to make his men and his department the most efficient it can possibly be and that requires hard work and co-operation.

A man who has been properly treated will not be afraid to go to his foreman and tell him about any ideas for improving methods for doing a job. It may happen that the foreman will be able to alter some small detail that will make the method a success even though it will not work as suggested. Then if the desired object can be obtained the foreman should give all credit to the workman and have him explain his ideas to the manager or superintendent. That will count for a great deal in the establishment of good will and in the promotion of co-operation.—H. MAPLETHORPE, *England.*

Getting Information from Catalogs

TO ME a catalog represents an endeavor on the part of a particular manufacturer to try to convey to me in as clear and as practical a manner as possible, a description of his products and various tools, in order that I can see their labor saving and production characteristics.

It is to be regretted, however, that there are so many of these catalogs that do not reach this standard and I am often surprised that the expense of their production is permitted. It is true that they are filled with photos of the various mechanical devices and machines and with lengthy discussions of their various parts, but if that machine was put in use in a customer's shop and needed repair, it would still be necessary to send for a representative of the manufacturer to put it back in service. I state this because if a machine is not so described that a mechanic or foreman in another concern can readily keep it in good running order, and quickly repair parts, that machine cannot be considered as labor saving and productive. Altogether too frequently have I been obliged to remove a part from a machine and send it to the manufacturer in order to duplicate it. —GEORGE A. MAW, *Foreman.*

Assigning Work to Machines

IN MY own shop, Al's suggestion of having a planning board with pockets to hold envelopes containing the blueprints and necessary instructions would be very satisfactory. The instructions should be on a card showing the complete layout of the operations, tools used, type of machine or the speeds and feeds and the quantity expected per hour. Another card should contain the order number and the quantity required as well as the date on which the parts are needed for assembly.

In large firms the planning department must keep in close touch with the foreman of each department. Frequently the foreman will desire a change in the method used or will be obliged to use a different method because the machines specified are all in use. It is the foreman's job to see that the tools are designed for use on as many types of machines as possible. Substitute methods should be developed ahead of time for jobs that occur frequently so that emergencies can be quickly met.—C. L. HENRY, *Foreman.*

Getting Information from Catalogs

THE first purpose of a catalog is to set forth the good qualities of the object advertised and to get it before the public. To set his particular line forth in such a manner that his public will grasp and understand its good points, the manufacturer must of necessity go into detail as to the quality of materials and workmanship and his particular machines ability to do the work required. No mechanic with an open mind can study such a catalog without some of the good points of construction, materials and operation lodging in his mind for further use.

I have before me all the time catalogs on machine tools and equipment and can and do go to them quite frequently for pointers. Pick up a catalog on belting and study it and one will gather a knowledge of belting and how to handle it that would require months of study in the shop from day to day. Anyone studying a catalog on milling cutters will be surprised at the fine points of set-up and operation to be gathered there. This past winter I received through the mail a catalog covering in detail a well known make of turret lathe. I had some parts coming through the shop that were routed for the screw machine but I had not planned my set-up yet. After studying the catalog I worked out a set-up for the screw machine job which saved considerable time. I don't believe it is a matter of getting help from catalogs so much as it is a matter of the foreman being willing to admit he gets help from them. Too many foremen like to have their superiors believe all short-cuts and suggestions originate in the foremen's minds. Superintendents and managers are not so easily fooled.

Any grinding wheel catalog contains an education on grinding wheels and I doubt if there is any one man whose mind holds as much such data as are to be found in such a catalog.—ARTHUR MUMPER, *Foreman.*

Ideas from Practical Men

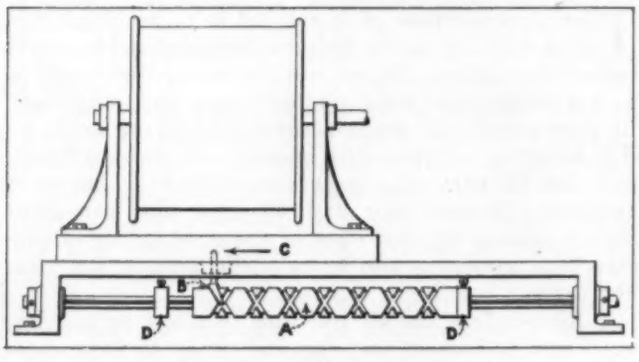
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Utilizing Lost Motion

BY R. H. KASPER

One point that has apparently been overlooked by designers of machinery is the possibility of making effective use of lost motion. In nearly every piece of machinery the designer strives to eliminate lost motion by the use of gibs on reciprocating parts and adjustable bearing caps on rotating parts, but the machines in which lost motion is deliberately utilized to effect a necessary hesitation or pause in the movements of the parts are comparatively rare.

Frequently a mechanism is complicated by cams and other devices to bring about a period of rest in the travel of a part, when by taking advantage of lost motion the same result could be attained by much simpler means. Recently I observed a simple application of this idea in a machine that was designed to wind wire upon reels.



Mechanism to utilize lost motion

The traversing motion necessary to guide the wire was accomplished by moving the reel back and forth while the wire was guided between two stationary pins. Originally the slide that carried the reel was actuated by cams, which were so plotted as to provide a uniform rate of traverse, interrupted at each end of the stroke by a definite period of rest.

It was found necessary, however, to vary the period of rest in relation to the time of traverse in order to meet varying conditions. The adjustments to provide for this variation were secured in the following simple manner:

A double screw *A*, having both right- and left-hand threads, was substituted for the cam to actuate the carrier. The length of this screw was equal to the maximum travel of the carrier plus a proportional amount equal to the period of rest required. A forked member *B*, engaging the screw, was so mounted in the carrier *C* that when it reached the end of the screw it would make a partial turn about its own axis to shift from the right- to the left-hand thread or vice versa.

The screw was cylindrical and was driven by a splined shaft upon which it was so mounted as to slide freely back and forth between two adjustable stop collars *D* by which its relative end movement upon the shaft was limited in either direction.

With the screw turning over away from the observer and bearing against the collar to the right, the fork *B* travels along the left-hand thread, pushing the carrier with it. When *B* reaches the end of the thread and is reversed by it to engage the right-hand thread, the friction of the carrier in its slide being greater than the friction of the screw upon its splined shaft, no movement of the carrier takes place until the screw has traveled along its shaft to abut against the collar to the left.

The rate of traverse imparted to the carrier by this mechanism is uniform at all times and in either direction so long as it is moving, but there will be a period of rest at the end of each reciprocation corresponding to the time required for the screw to travel along its shaft between the collars. The proportional duration of the period of rest is therefore determined by the setting of the collars.

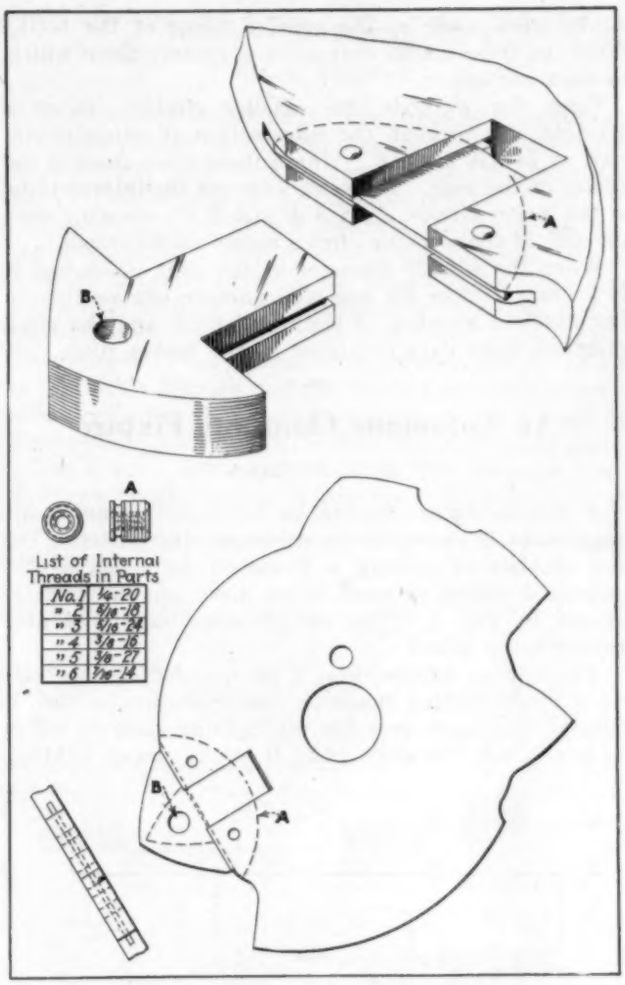
A Cam With Interchangeable Lobes

BY HENRY SIMON

We had an order for 15,000 of the parts shown at *A*, in the illustration, identical as to outside dimensions but with holes tapped with six different threads. Since the job was to be done on a No. 2 B. & S. automatic screw machine, it was clear from the start that it would not pay to make six different lead cams. Further parts of the same kind with still other threads were contemplated, and it was decided to try the experiment of using interchangeable thread lobes on the same lead cam.

The cam was figured on the basis of the piece having the hole tapped with the greatest number of threads, 27 per in., and it was formed with a seat for the thread-lobe sections. The seat consists of a flat formed on the periphery of the cam, interrupted by a large rectangular notch. The seat was slotted for the reception of the half-moon shaped piece of $\frac{3}{32}$-in. sheet metal *A*, tightly driven into place and further held by two rivets.

The stems on the thread-lobe sections were slotted correspondingly, but about 0.010-in. wider, and after case hardening the ends were sprung slightly together



Cam with interchangeable lobes

so as to give a tight grip on the sheet-metal leaf. The sections were made from ⅜-in. cold-rolled, flat stock, all six pieces being finished simultaneously except for the lobe curves. A hole, *B*, in each lobe was provided to admit a stout hook to facilitate its removal.

The work involved was not considerable and, since no close fitting was necessary, a very substantial saving in time of making the equipment over that of making six different lead cams—and probably further ones—was effected. The experience with the equipment proved very satisfactory. The exchange of lobes was rapid, and there was the decided advantage that no allowance of any kind, such as slight shifts of the turret tools, needed to be made in changing from one kind of part to the next, as might have been necessary when using different cams. All the operator needed to do was to pull out the lobe, drive in the new one, adjust the tap and go ahead.

It is clear, of course, that on some of the parts there was a time loss, due to a wait on the cutoff on the parts having the larger number of threads. There was a similar delay before and after the action of the tap lobe on the coarser threads. The extreme total loss was 3 sec. but the average figured about 1½ sec. At this rate, the interchangeable-lobe cam proved to be the best way out of the difficulty.

There are probably many cases where the individual parts in a series differ but little in size, where the use of cams with interchangeable lobes will result in a considerable saving in the tooling cost.

Grinding Spindle Boxes

By James Denton

The illustration shows the method of holding the half-boxes that support the work spindles of Norton crankpin grinding machines for the operation of grinding the outer surfaces. These surfaces must be accurately at right angles to each other and parallel with the axis of

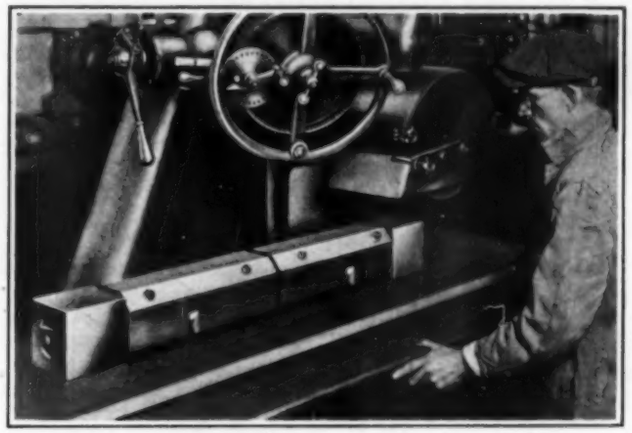


Fig. 1—Device to hold half-boxes to grind the flat surfaces

the bearing. The material of which the boxes are composed is hard bronze and there is from 0.008 to 0.010 in. of metal to be removed from each of two surfaces, with a tolerance of but 0.00075 inch.

The machine is a 15x15 in. x 6-ft., type G, open-side grinding machine regularly built by the Norton company. The wheel is a 14x6x5-in. Crystolon of 724 grit, grade I, vitrified bond. It runs at a peripheral speed of 4,000 ft. per min., and the table traverse is at 80 ft. per minute. The production rate is five pairs of boxes per hour, ground on both surfaces.

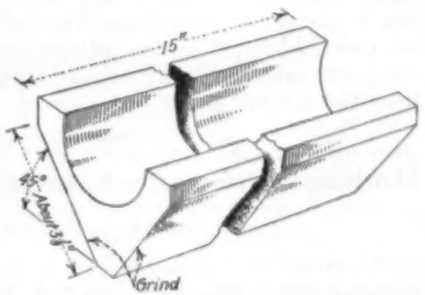


Fig. 2—The work to be ground

The work-holding device consists of a solid mandrel with square ends, the body of the mandrel being accurately ground to the size of the bore of the boxes. The work is attached to the mandrel by fillister-head screws, and no setting-up is required other than to place the assembled device on the surface of a magnetic chuck, turn on the current, and proceed with the grinding. A Taft-Peirce chuck is used.

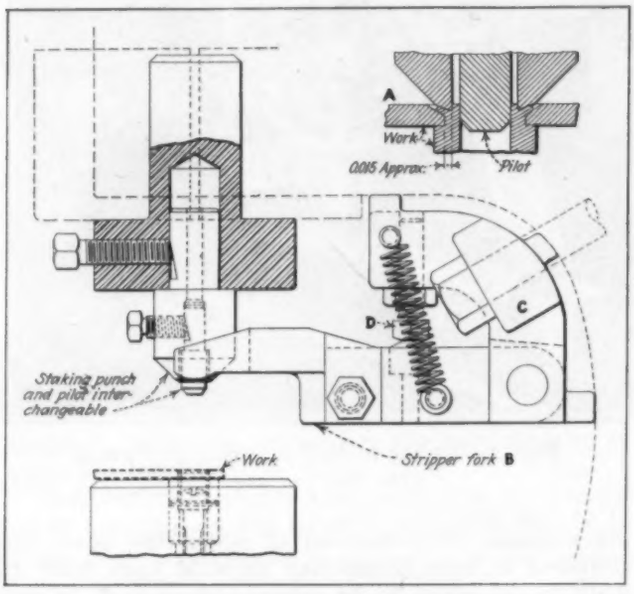
The accuracy of the 90-deg. angle included by the two ground sides is assured by the holding device. The ends of the mandrel are ground accurately square, and to reset after grinding the first side is merely to turn the mandrel over so that it will rest upon another face of the squared ends.

In work of such extreme accuracy it is, of course, necessary to take extra precautions to keep the smallest particle of dust from getting between the flat faces on the ends of the mandrel and the face of the magnetic chuck.

Ring-Staking Tool with Stripper

By L. L. Locke

Ring staking is applied extensively for joining small assemblies such as those used in cash registers, typewriters and calculating machines. In the illustration at *A* is shown an enlarged view of a staking punch, pilot and work as they appear at the bottom of the press stroke. The joined assembly often sticks to the punch



Ring-staking tool and stripper

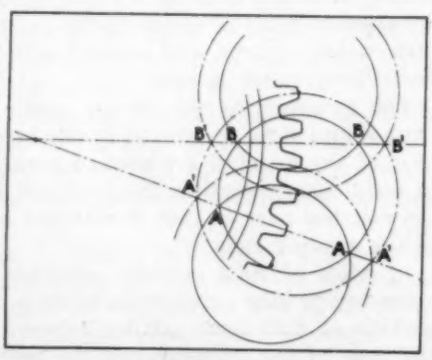
on the upstroke, therefore, an ejecting mechanism is advisable. At *B* is shown a stripping fork attached to the bracket *C*, so that it can move downward as the ram of the press is lowered. The upward movement of the fork is limited by the adjustable screw *D*, so that when the ram continues upward, the work is stripped from the staking punch.

Finding the Size of a Gear from a Segment

By Edwin L. Plummer

The article by Charles Kugler on page 493, Vol. 65, of the *American Machinist*, reminds me of an incident that occurred many years ago.

An order was sent to a shop for a new gear to replace a broken one. The order gave only two dimensions: the bore and the length of the hub. A section of the broken rim—the largest that could be found, and which was perhaps less than one-sixth of the circumference—was sent with the order to give an idea of the size. The accompanying sketch shows the method employed to find the center. The section of rim was laid on a flat surface, upon which marks were made at the tops of three of the teeth. Points on these marks were taken as centers about which to draw circles.



To find the center of a segment

Take, for example, the smaller circles. Draw a straight line through the intersection of adjacent circles, as at *AA* and *BB*. Where these lines cross is the center of the gear. The same lines cut the intersections of the larger circles, as at A^1A^1 and B^1B^1; showing that the size of the working circles makes no difference.

When the outside diameter of the gear is learned it is an easy matter for one who understands gearing to calculate the number of teeth, the pitch and the pitch diameter from data furnished by the broken piece.

An Automatic Clamping Fixture

By B. J. Stern

A milling fixture having an automatic clamping arrangement is shown in the accompanying sketch. The job consists of cutting a V-shaped notch across the outside diameter of small brass disks, one of which is shown in Fig. 1. The disks were finished all over before being milled.

The milling fixture, Fig. 2, is mounted on the table of a bench milling machine. In operation, a disk is slipped into place over the centralizing stud *A*, which is driven into the angle plate *B* in the proper location.

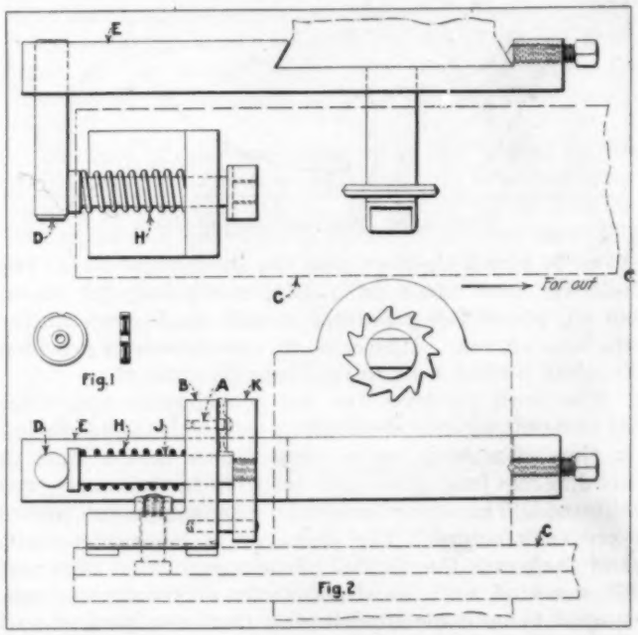


Fig. 1—The work to be milled. Fig. 2—Fixture for automatic clamping

The machine table *C* is then moved forward and away from the stud *D*, which is a drive fit in the plate *E*, clamped on the front of the milling-machine column, as shown in the illustration. Moving the fixture away from the stud *D* releases the stiff spring *H*, thus allowing its pressure to bear on the shoulder screw *J*, which communicates the pressure to the clamp *K*, causing it to pinch the work against the angle plate while the cut is being taken. After the notch has been machined, the machine table is moved back until the shoulder screw *J* strikes the stud *D*, thus compressing the spring *H* and forcing the clamp away from the work, which is then easily slipped out.

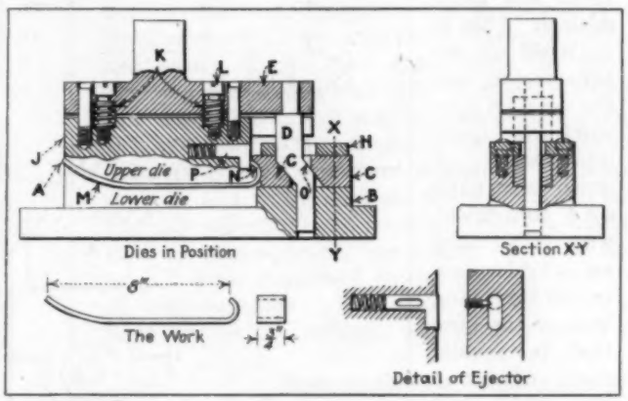
A Set of Bending Dies

By R. F. Keys

The work produced in the dies illustrated is a form of clamp hooked at one end and having an easy curve at the other. The forming dies are shown in part section, giving an idea of the principal details.

The piece to be formed is about 8 in. over all, and the material is $\frac{3}{4}$ x $\frac{1}{16}$-in. steel. The character of the hook at the end suggested the necessity for some kind of an end-closing die for the forming operation, and an end-acting ejector to strip the work from the upper die. The lower die-block, of cast iron, measures about 14 x 6 in. over-all. The die for this block seats up against a shoulder in the die base, the shoulder being formed by a projection slotted out to receive the end-closing die.

The work is shown in place at *A*. The lower die-block is shown planed out at *B* for the sliding member *C*,



Dies for bending a hook

which is adapted to be moved forward and back by the sloping-faced plunger *D*, carried in an extension on the upper die block *E*. The plunger *D* is of rectangular section, having its forward-sloping face made to act upon the corresponding face of sliding member *C*, while the rear-sloping shoulder is provided for the purpose of drawing the sliding member back when the press ram ascends.

Slide *C* is retained in its guide slot by a cover plate *H*. The slot in the cover *H* is sufficiently elongated to give ample clearance for the shoulder slopes on plunger *D*. The upper die *J* is fitted with $\frac{3}{8}$-in. dowels to serve as guide pins, while the stiff springs *K*, placed around the screws *L*, tend to force the die downward ahead of the upper die block itself. Similarly, when the forming stroke has been completed and the press ram starts to ascend, the pressure springs cause the die to dwell temporarily after the die-block starts upward.

In operation, the strip to be formed is dropped upon the lower die with its end resting between suitable stop shoulders. Upon the press being tripped, the upper die causes the work to be bent first at *M*, and at the same time the heel of the sharp bend at *N* is bent up at a right angle by being pressed down over the end of the side die. As the ram continues to descend, the work is forced into the dies along its whole length, and the sliding die *C* completely forms the hooked end.

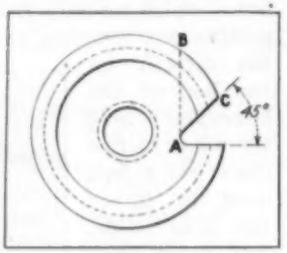
Upon the upstroke, the heavy pressure springs *K* hold the upper die and work temporarily in position, while the ram, continuing upward, causes the heel *O* on plunger *D* to force the closing die *C* outward to clear both the work and the upper die, which latter is then starting to lift. At this point, the ejector *P* is permitted to spring to the right and push the work out of the dies in a longitudinal direction, and to such an extent that the piece can readily be removed.

The ejector consists of a piece of rectangular steel, finished with a head $\frac{1}{4}$ x $\frac{1}{2}$ in. and a shank $\frac{1}{4}$ in. in diameter. The hole drilled in the upper die to receive the ejector shank, is deep enough to receive a stiff compression spring. In the side of the shank is milled a $\frac{1}{8}$-in. groove to receive the pilot end of a headless screw, which forms a stop to prevent the ejector from sliding out of its seat.

Gashing Circular Formed Tools

By H. B. Schell

The usual method of gashing circular formed tools for automatics, turret lathes and similar machines, is shown by the dotted line *AB* in the sketch. A method which we have found superior, from a tool life standpoint, is shown by the full line *AC*. This method provides the additional periphery *BC*, with the attendant increase in production from the tool before it becomes necessary to discard it, and in some cases might mean the saving of the difference in cost between one tool and two. The chip clearance is ample even on a new tool, and is increased with subsequent grinding.



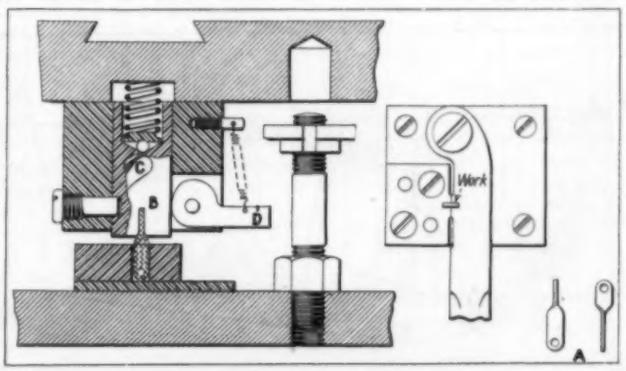
Circular tool with increased life

A Simple Twisting Die

By Lloyd L. Lee

The die shown in the sketch was developed for making the right angled twist in the small link shown at *A*. The link was first blanked and pierced in a progressive die from 0.040-in. strip steel, and was then placed by hand into the lower or stationary part of the twisting die, where it was held in a vertical position by a simple, swinging lever.

The plunger *B* has a helical groove at *C*, milled at the proper angle to give it a 90 deg. twist within the distance the press ram travels after being seated the link. When the ram is up and the link placed, the lower end



Press tools for twisting small parts

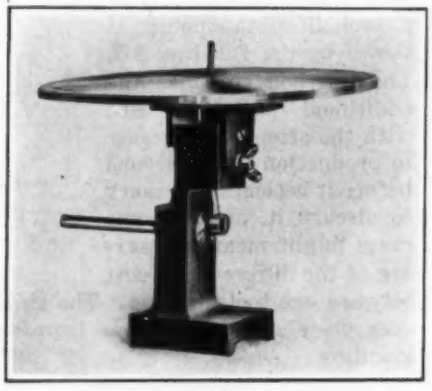
of the plunger just clears the link. As the ram comes down, the plunger comes down with it until the link strikes the bottom of the slot, stopping the downward motion of the plunger. Further downward movement of the ram causes the plunger to revolve under the action of the hardened pin in the helical groove.

The cam *D* is actuated by a light spring and causes the plunger to remain stationary in its sleeve on the upward stroke until clear of the part, at which time the end of the cam hits the adjustable stop on the stud, when the heavy spring returns the plunger to the starting position. This die is as easy to operate as any simple forming or trimming die and requires little or no upkeep.

Filing Attachment for a Bench Lathe

BY E. PALMQUIST

The illustration shows a filing attachment for a bench lathe, which we built from scrap, and find very useful in getting out templets and form tools. The attachment fits directly on the bed of the lathe, and is held by the same clamping bolt used to fasten the tool slide. The drive shaft carries an eccentric for giving the reciprocating motion necessary for filing, and fits one of the draw-in collets in the lathe spindle. A table about 14 in. in diameter is supported on pivot points, and can be tilted and locked at any angle up to 15 deg. either side of horizontal. A standard filing-machine file having a ⅛-in. round shank, grade No. 00, is used with good results.



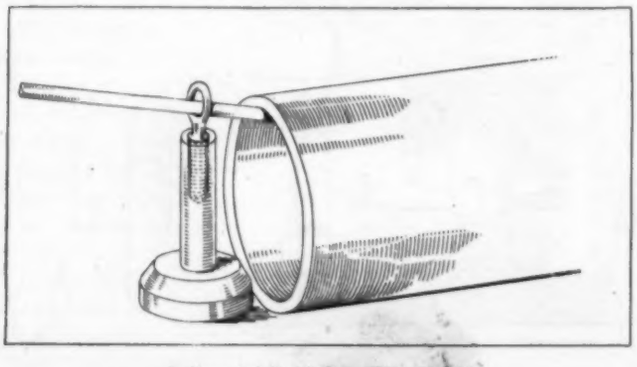
Filing attachment

An Adjustable "Scotch"

BY H. MOORE

For raising heavy pipes of various diameters an Eastern yard is using a handy tool in the form of an adjustable "scotch," as shown in the illustration. The amount of lift required in most cases is about six inches, one end at a time on to two planks laid parallel to form rails. The device has a strong base, threaded to receive an eyebolt, the eye of which is large enough for the bar to be slipped through and to allow it to be moved around.

The device is easily set to height by screwing the eyebolt in or out. This tool is a safe one to use, since it is impossible for the bar to slip out of the eye of the bolt.

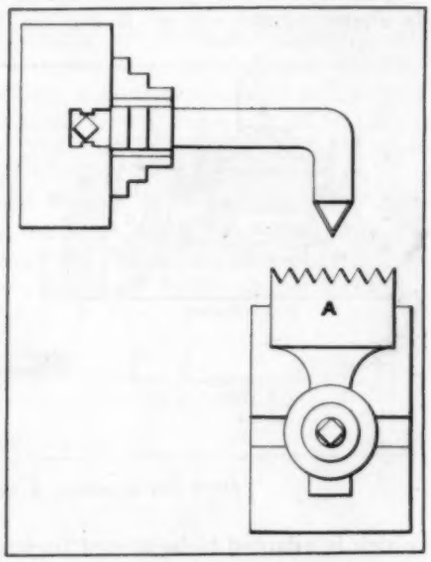


A "scotch" that will not slip

Simple Way to Make a Thread Chaser

BY CHARLES KUGLER

When a chasing tool as shown at *A* is to be made for a special thread and there is no tap available with which to make it, it is the usual practice among toolmakers to make a hob of the form and pitch desired. This is in itself an expensive job, and for ordinary work is quite unnecessary. A much simpler and convenient way is to take an ordinary inside threading tool, of the kind that is usually made of round bar stock and held in some form of clamp holder, grip it in the lathe chuck as shown in the sketch, and gear the lathe to cut the desired pitch. The boring tool will act as a fly cutter.



Making a chaser

With the chaser blank held in the toolpost, the teeth can be cut in the blank by the same method of procedure as in cutting an outside thread.

This method saves the time and expense of making a hob for each pitch or form of thread. By making the tool short and stiff it works satisfactorily.

A New Use for an Old Tool—Discussion

BY ALFRED T. GREGORY

The article by George Conover, under the title given above, and published on page 295, Vol. 65, of the *American Machinist*, explains a very valuable use for the thread gage as a time and labor saving device. There is one feature of its use, however, which I think deserves a little amplification. The leaf of the gage is usually from ⅛ to ¼ in. thick and, therefore, leaves an impression on the paper that is not an ideal guide for drawing threads.

The remedy is to grind a bevel on one side of the gage until the points of the teeth are about 0.010 in. thick. That will make it very easy to place the gage directly on the line and it requires much less pressure than before. Furthermore it will leave a row of points; not wide lines to draw from.

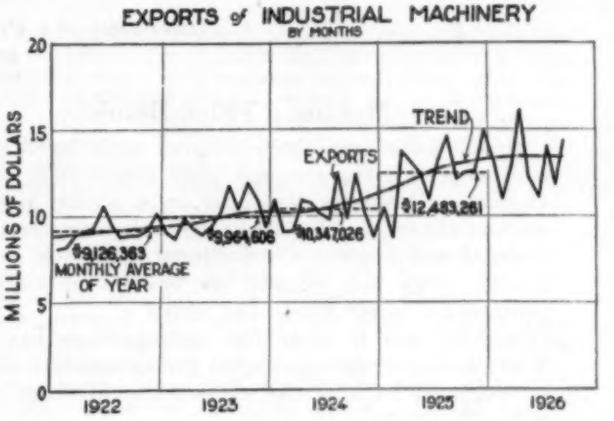
Activity in the Metal Working Industries

Industrial Operations Continue High

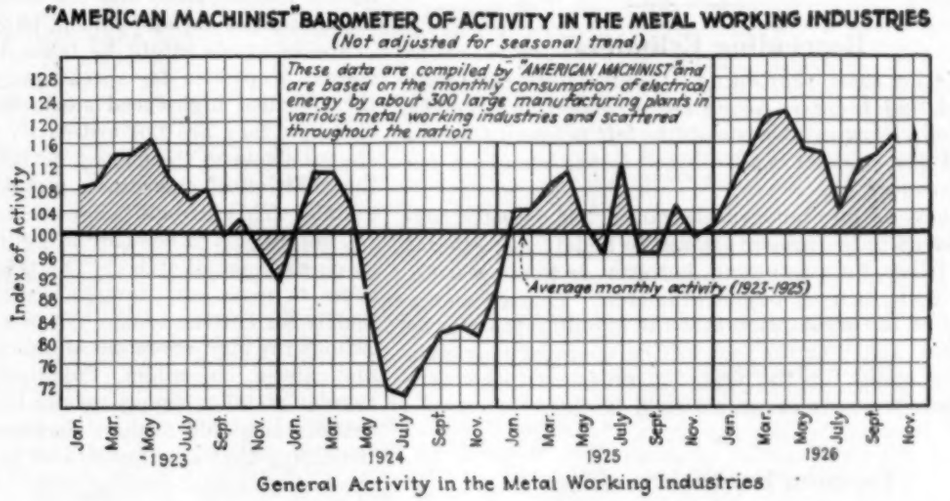
Reports on electrical energy consumption by the metal-working industry of the country indicate a slightly increased rate of activity in those plants during the month of October. An upward turn in the operation of the metal-working industry was reported for August, and energy consumption reports indicate that this upward trend has continued. In October the industry was operating at a rate 2.5 per cent higher than in September, and about 12 per cent higher than in October of last year.

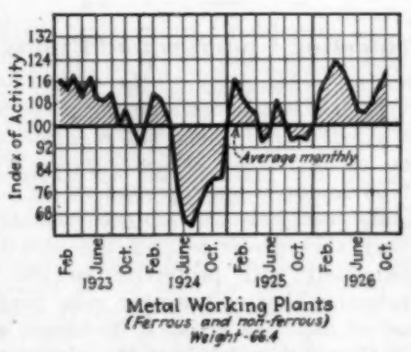
The downward trend in the operations of the automotive and shipbuilding industries was continued during October. Operations in these plants during October were 9.2 per cent below those of September, and about 16 per cent lower than the operations reported for October of last year. Activity in the railroad repair shops was increased during October.

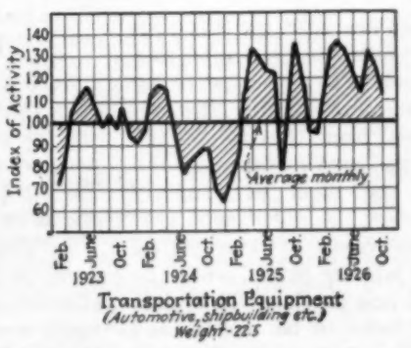
This high rate of activity in the metal-fabricating industry is but a reflection of activitiy in industry in general, and in the general business of the country. The fall industrial and trade activity has been larger than in mid-summer, the higher level of business having been sustained by an unusual combination of circumstances. The probabilities are that the main trends of business will be downward during the next few months, but nothing even approaching a depression is indicated. The chart on the exports of industrial machinery indicates a healthy trend in the foreign outlet for American machines.

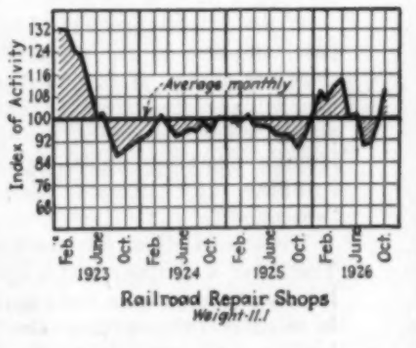


The monthly figures for electrical energy consumption are collected by the *Electrical World*, and the material for the chart on exports is furnished by the Department of Commerce.


"AMERICAN MACHINIST" BAROMETER OF ACTIVITY IN THE METAL WORKING INDUSTRIES
(Not adjusted for seasonal trend)
These data are compiled by "AMERICAN MACHINIST" and are based on the monthly consumption of electrical energy by about 300 large manufacturing plants in various metal working industries and scattered throughout the nation
Index of Activity
128
124
120
116
112
108
104
100
96
92
88
84
80
76
72
Average monthly activity (1923-1925)
Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov.
1923
1924
1925
1926
General Activity in the Metal Working Industries







© American Machinist

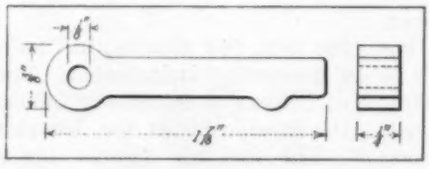
Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Making a Thick Blank

Q. We have large quantities to make of the brass part shown in the accompanying illustration, and are at present blanking them out on a punch press and drilling the hole. The blanks, however, come very much rounded and require a subsequent operation for flattening. Can you suggest an economical method of obtaining a better job on the piece?

A. This job is ideal for cutting from bar stock. Write to any of the brass mills for an estimate on rolled or extruded bars of the cross-sectional shape of the part. The parts can be sawed off the bar rapidly with a thin circular saw, and only a burring operation will be needed before drilling. You will undoubtedly find that a better job can be obtained at a lower rate per piece than by the present method.



Regrinding Cylinders

Q. We do some regrinding of automobile cylinders, and find that there is considerable contention over the amount of clearance that should be left between the piston and the cylinder wall. What is the standard for this clearance?

A. There is no standard clearance, and manufacturers differ as to the proper amount to be left. A general rule to follow for regrinding, however, is to allow 0.001 in. for each inch of piston diameter. This clearance is based on the assumption that the grinding job will be first class, and that the car will be operated only at a moderate speed for the first 500 miles. Otherwise a somewhat greater clearance should be left.

Lapping Parallel Surfaces

Q. How is the lapping done on block gages to insure absolutely parallel surfaces?

A. Special machines have been designed for this purpose, and are in use wherever precision gages of this class are made. It is almost useless to expect perfectly parallel surfaces from grinding and lapping the opposite sides separately, or even from the use of the lapping machines unless extreme care is taken in the grinding and lapping, and the steel is properly "seasoned."

The essentials of the machine consist of three plates. The lower and upper plates are lapping plates, while the intermediate plate is the gage block carrier. This plate is slightly thinner than the blocks to be lapped, and has holes near the circumference which carry the gage blocks and allow both surfaces of the blocks to come in contact with the lapping plates.

The upper and lower plates do not rotate, but the upper plate is free to descend towards the lower plate as lapping proceeds. The carrier plate rotates and oscillates at the same time. In order to equalize the lapping, the blocks are transposed diametrically and at 90 deg. at various times during the lapping process. Special apparatus is employed to measure by light waves the flatness and parallelism of the surfaces to limits much beyond any ordinary commercial requirements.

Designations of Special Steels

Q. What is the exact definition of special steel, and what is the distinction between special steels and alloy steels.

A. We do not know of any authoritative definitions for these terms. The term "alloy," of course, is very broad, and would include any combination of metals intimately united in a solid solution. Combinations of a metal with a non-metal such as carbon are not in reality alloys. Alloy steels are steels containing other metals besides iron, and the term has no reference to the content of carbon, silicon, phosphorus, or sulphur.

Special steels might be taken to indicate steels with special properties for special purposes. In such a case the so-called high-speed steels would be special steels, although they are not ordinarily classed as such. The special steels on the market derive their properties from the addition of chromium, nickel, vanadium, and other metals. They are all "alloy steels."

There seems to be no dividing line between high-speed steels and special steels. The term high-speed steel has come to mean any tungsten alloy steel employed primarily for cutting tools. The A.S.T.M. standard specifications for high-speed steels indicate that iron, tungsten, manganese, chromium, vanadium, and cobalt are the regular metallic components in the steel, but the specifications also add "other elements as agreed," clearly indicating that a manufacturer is free to include special steels containing other elements under the designation of high-speed steel if he so desires.

Protecting Underground Piping

Q. We are replacing some of the underground pipe lines that cross the yards between the plant buildings, and we are wondering if you could suggest some inexpensive way of protecting the new pipes from rust. The old piping has been underground only a few years, and is so badly rusted that it is practically useless.

A. The only sure protection for the pipe line is to cover it completely with protective jackets. But an effective protection that will answer your purpose is to apply a coat of asphaltic paint to the pipe, and after the paint is thoroughly dry coat the piping well with hot asphalt. This treatment is not expensive, and will add years of life to the piping.

Technical Abstracts

Sheet Zinc as a Roofing Material

The United States produces more zinc than any other country, but of all the progressive countries of the world, it is the least appreciative of the superior qualities of zinc for roofing and for other purposes well known and much valued in Europe.

Ages of exposure to winds and weather do not injure a zinc roof. Zinc roofing is always new because it cannot rust. It maintains the same beautiful soft gray color permanently. Zinc is also lighter than other roofing materials, and does not crack or warp. It costs about half as much as copper, taking an average for a period of years.

Zinc stands best when it is not in contact with any other metal. The largest tonnages of sheet zinc in Europe are for roofing, cornices, gutters, leaders, and flashings. In all of these cases, painting is unnecessary.—*The American Zinc, Lead and Copper Journal*, Sept., 1926, p. 6.

Fatigue Tests on Cast Iron

Small bars of cast iron were tested with a cantilever load in a testing machine rotating at 1,000 r.p.m. The effective length of the specimen was 6 in. and the diameter ½ in. turned from squared bars, cast horizontally. An analysis showed the following percentages: silicon 2.42, sulphur 0.112, phosphorus 1.379, and manganese 0.65. Tested statically, the bars broke at 50,000 lb. per sq.in. according to the beam formula, although a direct tension test, paradoxically, resulted in failure with less than half this stress.

A load on the beams resulting in a stress of 21,700 lb. per sq.in. gave lives in excess of ten million revs., while a stress of 32,500 lb. per sq.in. resulted in almost instant failure. Stated in per cent, if static fracture occurs at 100, then immediate failure will occur at 65 under a rotating stress, while a load of 43.5 can be carried indefinitely. The curve connecting these points is hyperbolic in shape.—Prof. C. H. Bulleid in *Engineering*, Oct. 1, 1926, p. 429.

Small-Plant Equipment Problems

In many small plants standard equipment is in use that is well adapted for the work in hand, but when machines become obsolete, the question arises as to whether the small plant can afford to sell or scrap the old machines and buy new ones. Although desirability may be evident, the changes may involve so much additional capital as to be impractical. Improvement on present equipment should then be considered. If any of the production men or engineers are of an inventive turn of mind, changes of a profitable nature may be devised. Occasionally it is feasible to employ the services of an outside specialist, but unless the betterments are substantial it usually does not pay to spend much money in this form of experimenting.

Machines that cut down the number of operations or are largely automatic usually justify the investment they involve. Replacements in those departments where the greatest savings can be accomplished come first, and most small plants will find that here the limit has then been reached as far as tangible results go. Re-arrangement of machines often yields profitable returns with a small outlay of cash. Changes that introduce inexpensive material-handling devices that save much time and labor generally yield good returns. —Henry P. Wherry in *Manufacturing Industries*, October, 1926, p. 257.

Melting Steel and Gray Iron with Electric Heat

From the report of the power committee of the N.E.L.A., it is evident that the use of the electric furnace is growing, particularly in the steel casting industry. It has all the advantages of the cupola converter process, with none of its disadvantages, as the metal is poured on a clean hearth with a clean source of heat and under an atmosphere that can be made oxidizing, reducing or neutral, as desired. Control of temperature and chemical content is most accurate. Small heats are possible and small, thin-sectioned castings can be poured economically. In a test of an electric furnace against a cupola, duplicate charges being used, the former produced iron that was practically unchanged in chemical content while the result from the latter was richer in carbon and sulphur through contact with the coke. The chief advantages of the electric furnace for iron castings are: The ability to make better cast iron than is possible with a cupola; a smaller percentage of defective castings; a lower tool cost for machining; machine labor cost lower by reason of less work wasted on poor castings that had to be scrapped; peak rate can be lower, and castings are not hard; easier regulation of analysis and temperature; better pouring facilities, particularly on small jobs; ability to take care of emergency conditions. — *Electrical World*, Oct. 2, 1926, p. 709.

Circular Wood Saws

A detailed study has been made of the action of various kinds of saw teeth on both hard and soft woods, either with or across the grain. In general, the cuts in hardwood are proportionately smoother than softwoods on account of the texture and stiffness of hardwood fibers. But for any cutting operation, the finest surfaces can never be obtained with saws having set teeth; hollow-ground blades having no set will produce a smooth cut at the expense of power and production, but a later finishing operation may sometimes be eliminated.

Otherwise, the factor having the greatest influence on the quality of cut is the specific rate of feed, or the number of teeth coming into contact with the surface per unit time. In cross-cutting particularly, it is essential that the speed of the blade be kept high, while in ripping it is more essential that the shape of the teeth be correct and that a splitter be used. In the latter case, the blades should be backed up on top for strength, should have undercut front edges, which should be filed square with the blade body, and should have their cutting edge leading off close to a right angle to the blade body, measuring from the point of set. The undercut front edges provide sufficient scavenging space to permit rapid ripping. The quality of cross-cut work, on the other hand, is independent of the type of saw tooth.

In either class of sawing, best results are obtained if enough power is supplied to keep the blade up to speed under even the most severe conditions. It is recommended, therefore, that a 5-hp. motor be used for general cut-off work, where a 3-hp. motor is now practically standard.—J. A. McKeage in *Mechanical Engineering*, October, 1926, p. 1005.

Springs from Monel Metal

When springs are exposed to dampness or chemicals that cause them to rust and corrode, monel metal makes a satisfactory material. In the past, spring wire of this metal has not been available, but during the last two years the W. D. Gibson Co., in co-operation with the International Nickel Co. and the Driver-Harris Co., has made a study of the possibilities of using monel metal for springs, and has developed methods for cold-drawing this metal, so that now a uniform and reliable grade of monel metal spring wire is available in sizes up to ½ in. in diameter.

This metal has a torsional strength of 135,000 lb. per sq. in., a torsional modulus of 9,250,000, a tensile strength of 135,000 lb. per sq. in., and a tensional modulus of 25,000,000. The safe working stress in torsion for monel metal in cases where fatigue is not a factor is said to be 70,000 lb. per square inch. In cases where fatigue is a factor and it is desired that the spring shall operate 2,000,000 times without fracture, a safe working stress in torsion of only 30,000 lb. per square inch should be employed.—*Machinery*, October, p. 103.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Education Needed in Installment Buying

IN SOME quarters the ills of installment buying are taken too seriously. "Mortgaging the earning power of the future," installment buying is sometimes called. And that is exactly what a business does every time it borrows money to satisfy immediate needs, a basic business procedure.

After all, installment buying is part of a vicious circle or a profitable cycle, depending upon the point of view. The purchase of automobiles, radio sets, washing machines, gives the producers the privilege of employing men to build more of those commodities, and the men are given the chance to use them, wear them out, and buy more.

What probably is needed is education in installment buying, to prevent sheer foolish and improvident buying. Budgeting education might fill the bill, with the result that there would be even greater buying, that would be universal.

Where Subdivision of Labor Increases Costs

SCIENTIFIC managers have long preached the subdivision of labor as essential to economy in modern industry. Labor resisted the innovation at first, but judging from the experience of many exhibitors at the Chicago exposition, labor has adopted the idea in its entirety, plus a few extras. One example will suffice.

An exhibitor of a large motor driven machine shipped the machine and motor separately. On its arrival the draymen delivered the crates to the booth. Crates, being made of wood, must be handled by carpenters, who took off the top. The motor had to be taken out by electricians. The riggers hoisted it to the top of the machine. Electricians had to line it up, (just why, isn't clear) and connect it. But the bolts had to be screwed down by a full-fledged machinist.

And here is another fine point. The wrenches of the exhibitor, that were made for the job, wouldn't answer. The machinist, having taken a lesson from the proverbial plumber, went back to headquarters for his own wrenches.

All this was, of course, charged for at full rates, by each type of mechanic, so that getting the machine ready to run was somewhat expensive.

While labor leaders may claim as much justification for this subdivision as for that practiced in manufacturing, there is a fundamental difference —the quantity of the product. If there were several hundred of the same machines to install, it might be justifiable to use a different man for each operation. But no manufacturer could subdivide operations on such a limited output.

There is one principle to be borne in mind by both manufacturers and labor leaders. No industry can succeed that does not adopt the methods that secure economical production. When labor uses methods that make the cost unnecessarily expensive, it is running contrary to the laws of economics. And these methods cannot prevail even with the aid of political organizations.

This is not a question of wage rates. We all realize that poorly paid workers mean a market limited to necessities. High wages and economical production can and should go hand in hand. Any method that deliberately and unnecessarily increases costs cannot survive.

While extreme sub-division of labor is necessary in mass production, there are many cases where economy demands varied operations from one man. No method that compels deliberate waste can hope to survive.

The Social Aspect of Mass Production

ALL due credit to mass production and its results. But we must not overlook the fact that the nation which can carry on a successful program of mass production must have the proper educational and social background.

For thirty-five years our technical and business schools have been pouring the right kind of brains into our industrial world—so we have brains on a mass-production scale. For a much longer period the man of industry and commerce has had no limit to the social heights he is permitted to climb—so we have the social recognition of mass production.

Moreover, the society that honors the man of industry, and the man of industry himself, being open-minded and forward-looking, are prone to accept scientific discoveries, apply new machinery, and eliminate waste. The attitude of labor toward production, which could be fatal, is very far from narrow.

With the continuous recruiting of brains, with our great competitive machinery for selection of the fittest by the sifting process, with no social obstacles—with leadership coming from the ranks—our success is bound to continue.

Have You a Replacement Policy?

Shop Equipment News

Sellew Multiple-Spindle Drilling Heads

The Sellew Machine Tool Co., Pawtucket, R. I., has designed two multiple-spindle drilling heads to be used in conjunction with standard drill presses.

In Fig. 1 is shown an eight-spindle device with the spindles set at an angle of 30 deg. It is intended for

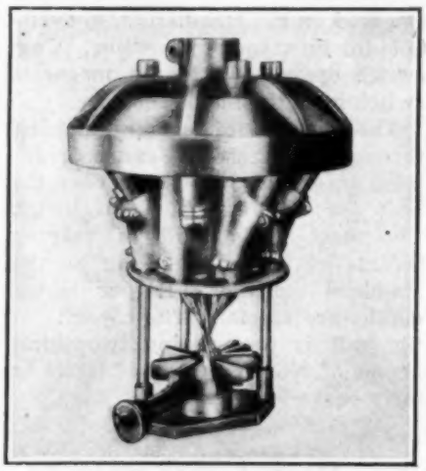


Fig. 1—Sellew Multiple-Spindle Drilling Head

the purpose of drilling small, closely-spaced holes in the angular surfaces of gas burners. The head clamps to the quill of the drill press in which it is used, and the mechanism is driven by a tapered shank that engages the spindle of the machine. The drive is through a central gear that meshes, through intermediates, with a spiral gear on each small spindle. All gears are of bronze.

The small heads are entirely independent of each other and any one may be adjusted or removed from the device without interfering with the others. Once established for a given device, the angle is fixed, but the device can be furnished with the spindles at any angle from 15 to 45 deg., inclusive.

In operation, the entire head feeds down until a fixed stop is reached; this movement being performed by means of the hand feed lever of the drill press. The power feed is then engaged, and the small spindles advance parallel to their axes.

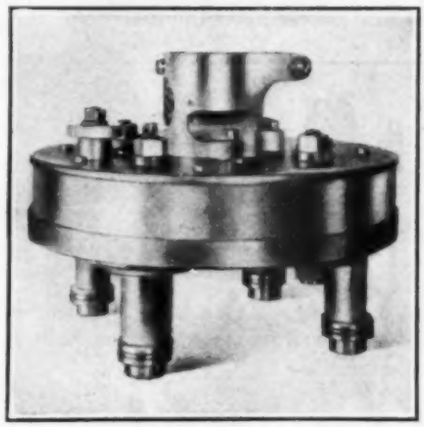


Fig. 2—Adjustable Head to drill motor frames

In Fig. 2 is shown a device for drilling four equidistantly spaced small holes in a circle, or at the angles of a square, the diameter or dimension of which may be changed within a limited range. It is particularly adapted to the drilling of holes in motor frames in a range of sizes. This device also clamps to the quill of the drill press, and the small spindles are driven from a central gear, which derives its power from a connection to the spindle of the machine.

The small spindles run on ball bearings and the thrust is also sustained by ball thrust bearings. Each spindle has a No. 2 Morse taper hole. The diameter of the circle in which the small holes are drilled is determined by turning the knurled knob

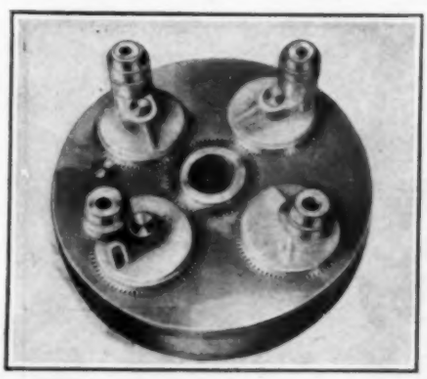


Fig. 3—Underside of the device shown in Fig. 2

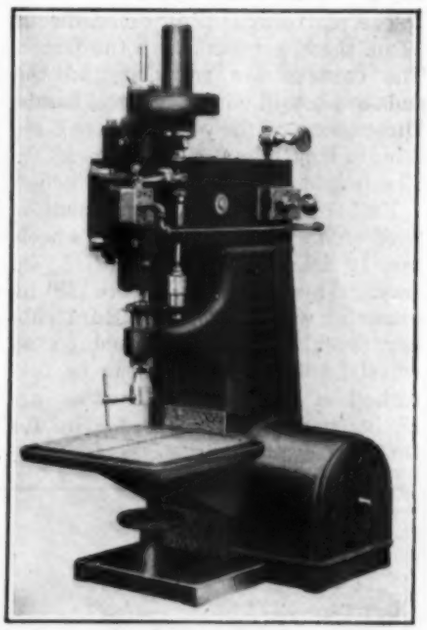
to be seen at the left on the top of the disk in Fig. 2. The spindles are adjusted simultaneously. A clamp screw is provided to lock the spindles in the desired position.

In Fig. 3 the device is shown inverted to display the adjusting mechanism.

Simmons Pneumatic Tapping Machine

The pneumatic tapping machine illustrated is being marketed by W. H. Simmons & Co., 208 Lawrence Street, Cincinnati, Ohio. It is designed for high-production operation. The capacity of the machine is for tapping holes $\frac{5}{16}$ in. in diameter in steel and $\frac{1}{4}$ in. in diameter in brass and other soft metals. It is built in a bench type only with a single spindle design as shown.

Spindle speeds as high as 3,000 r.p.m. are available. Reversal is taken care of automatically through



Simmons Pneumatic Tapping Machine

the use of compressed air. It is only necessary to set the reversing nuts to a specified depth. By means of a patented lead and nut attachment, the effect of chasing threads is obtained. The maximum stroke of the spindle is $1\frac{1}{2}$ in. and the minimum

Shop Equipment News

stroke is ½ in. A positive-drive chuck is provided, but a safety device protects the taps in case the operator fails to locate the hole to be tapped directly under the tool. A fixture is not required to hold down the work during the tapping operation; however, a fixture to prevent the work from turning is necessary.

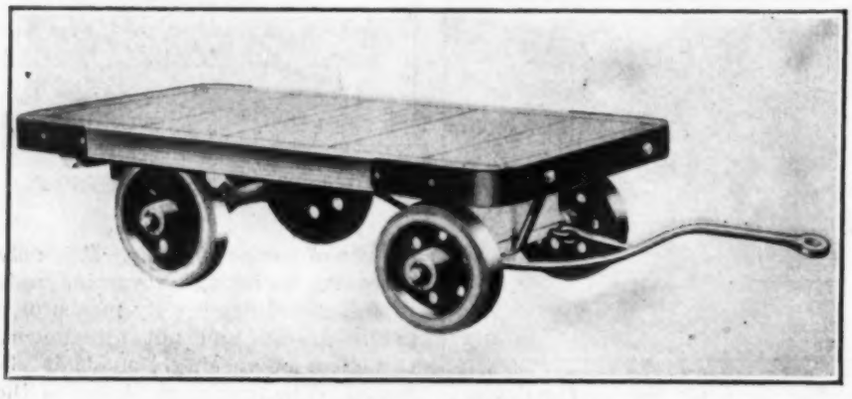
The table is adjustable by means of a screw and hand wheel and is of the knee type. A special table or fixture can be substituted for it, if necessary. Regular equipment includes a ½-hp. motor located in the base of the machine. It drives by means of a belt and a tightener idler pulley. Ball bearings are used throughout.

Clark Fifth-Wheel Trailer

The rubber-tired fifth-wheel trailer shown in the accompanying illustration was developed by the Clark Tructractor Co., Buchanan, Mich. The tongue is used for both steering and coupling either one to the other or direct to the tractor. It has a capacity of 3 tons and is designed for use with bulky loads.

The platform is built of hardwood 1¾ in. thick, set flush with the frame. The corners are rounded and the ends are bound with 4-in. steel bands. Dimensions of the platform are 6 ft., 3 in. in length by 3 ft., 0 in. in width. The height of platform is 20 inches.

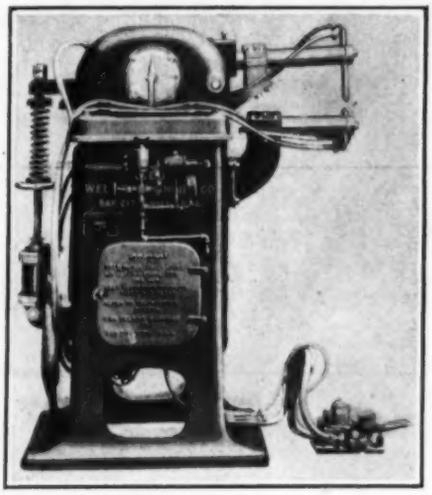
Full Hyatt bearing equipment is used on all wheels. The front wheels are 15 in. in diameter with 3½-in. face. The rear wheels are 18 in. diameter with 3-in. face. Hard rubber truck tires are pressed on all wheels, but steel wheels can be furnished if desired. The axles are 1¾ in. square, turned to 1⅞ in. for the wheel spindles.



Clark Fifth-Wheel Trailer

Gibb "Hi-Speed" Air-Operated Spot Welder

The "Hi-Speed" air-operated spot welder illustrated is being marketed by the Gibb Welding Machines Co., Bay City, Mich. This type of control is said to eliminate the fatigue of the operator and to produce uniform welds through uniformity in heat pressure, and time. In welding sheet metal of No. 18 gage and heavier, an increase of speed over hand operation can also be obtained.



Gibb "Hi-Speed" Air-Operated Spot Welder

The construction of the machine is simple. On the top of the welder, there is a movable lever, on the end of which is the electrode and wiring connections. On the rear of this arm is attached the piston rod held in knife edge contact by means of a large compression spring. The air cylinder itself is mounted on a trunnion so that it swivels with the movement of the upper arm.

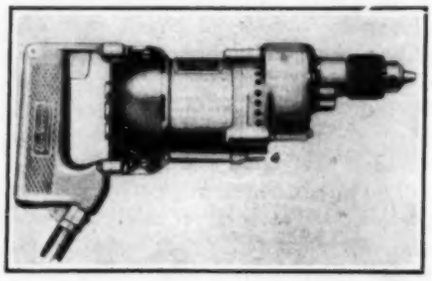
This air cylinder is 3¼ in. in diam. and the piston has a 3½-in. stroke. Since the leverage on the upper arm is approximately two to one, a stroke of 1¾ in. is obtained at the electrode.

By means of a regulating valve, pressure on the electrodes can be varied from 10 to 100 lb. depending upon the work and the pressure of the available air supply. Further adjustment of the welding pressure is also obtained through the compression spring. Control of the arm movement is by means of a foot valve that operates with a small stroke. An automatic remote-control switch mounted on the treadle is also available for this type of operation. This switch operates in turn a magnetic switch mounted inside the base.

The amount of current flowing through the electrodes can be regulated in six steps so as to vary the heat for different gages of metal. The machine is built in varying throat depths up to 24 in. on the standard machine. Larger throat depths are special. The capacity of the unit is for welding two thicknesses of No. 7 gage sheet metal or their equivalent.

Van Dorn ¼- and 5/16-In. Portable Electric Drills

The Van Dorn Electric Tool Co., Cleveland, Ohio, is marketing two improved sizes of portable electric drills, ¼- and ⅝-in. These tools are equipped with ball bearings throughout and are more heavily powered than previous models.



Van Dorn ⅝-In. Portable Electric Drill

Each drill has a trigger switch that shuts off automatically when finger pressure is removed. An improved form of cable attachment is also used in both cases. Hardened alloy steel gears are employed throughout. The universal motors

Shop Equipment News

operate on either alternating or direct current.

The smaller tool has a capacity for drilling holes ¼ in. in diameter in steel. The no-load spindle speed is 2,000 r.p.m., while its full-load speed is 1,200 r.p.m. The drill weighs 5½ lb. net, and its over-all length is 11¼ inches.

The larger drill is capable of drilling holes ⅜ in. in diameter in steel. The no-load speed is 1,500 r.p.m., while the full-load speed is 900 r.p.m. This size of drill weighs 7 lb. and measures 12½ in. in over-all length.

Both models are furnished with a grip handle, a three-jaw chuck and 10 ft. of cable with plug.

"Niagara" No. 05 Extra-Heavy Circle Snip

The Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, has developed the extra-heavy, curved-lip, cutting snip shown in the accompanying illustration. The snip

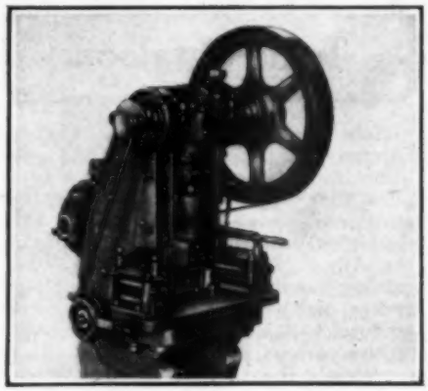
"Niagara" No. 05 Extra-Heavy Circle Snip

is designed especially for cutting heavy sheet metal used in the automobile body industry. The features claimed for the "Niagara" snip are a snugly fitted pivot bolt, and keen cutting edges that retain their sharpness. A comfortable hand grip is also claimed for the snip.

Roll Feed for "Standard" Presses

A double-roll feed for punch presses, by which the space before and behind the tools is not obstructed by shafts, connecting links, etc., has been brought out by the Standard Machinery Co., Auburn, R. I., to be applied to any of its presses of the open-back type.

The feed is operated by a friction ratchet, the movement of which is derived in the usual manner from an adjustable crankpin in a disk keyed to the end of the press shaft.



Roll Feed for "Standard" Presses

The ratchet wheel is keyed to the end of a transverse shaft that extends behind and below the level of the die-bed. Movement of this transverse shaft is transmitted to both pairs of rolls through helical gearing.

Link-Belt Silent Chain Drives

The Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., announces that stock sizes of silent chain drives are now available from distributors at ratings from ½ to 15 hp. in almost any reduction ranging from 1 to 1 up to 7 to 1. Formerly these stock sizes were only carried as far as 10 hp. These stock drives do not, of course, interfere in any way with engineering drives that this company furnishes in sizes up to 1,000 hp. or over.

"Ozalid" Printing Paper

Eugene Dietzgen Co., 954 Fullerton Ave., Chicago, Ill. has developed a so-called "Ozalid" printing paper. It produces a positive print with a dark red or maroon line on a light cream background direct from the original tracing without the use of a negative.

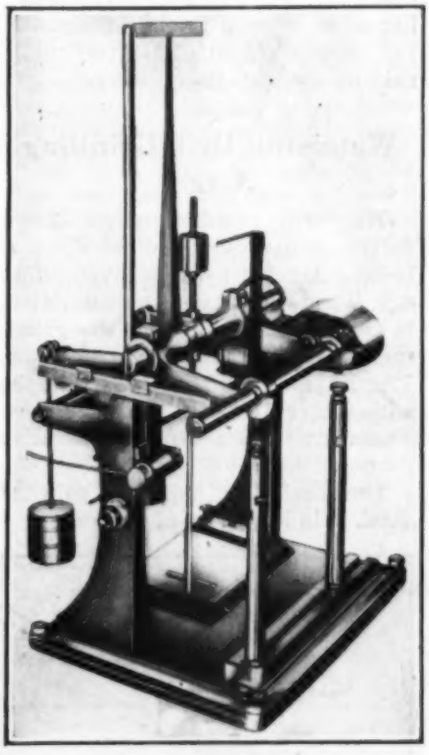
Ozalid is printed in the same manner as blue prints, but is developed dry by brief exposure to ammonia-water vapor. Because of this method of development it is said that the paper does not shrink or wrinkle and is true to scale, beside retaining its original strength.

The print produced is non-fading and can be shaded and colored, or written upon with pencil or ink. Prints made on thin Ozalid paper can be used for reproduction.

Olsen Automatic-Weighing Balancing Scale

The automatic-weighing balancing scale shown in the accompanying illustration has been developed by the Tinius Olsen Testing Machine Co., 500 North Twelfth St., Philadelphia, Pa., for use in the static balancing of single turbine wheels, disk wheels, and other parts where dynamic unbalance is not present. The balancing spindle is motor driven and it is claimed that with this improvement the production in the number of parts balanced is practically doubled over the old hand turned model.

The parts to be balanced, such as a flywheel or clutch part, is mounted directly on the end of the balancing spindle. By means of a motor drive, this spindle revolves four times a minute and after approximately two revolutions the operator can determine all data as to amount of unbalance as well as the angle. During the turning operation the weighing system is held steady by means of an operating handle at the front. When the pointer shows a maximum deflection, the scale is balanced; the part is then turned 180 deg. and the



Olsen Automatic-Weighing Balancing Scale

Shop Equipment News

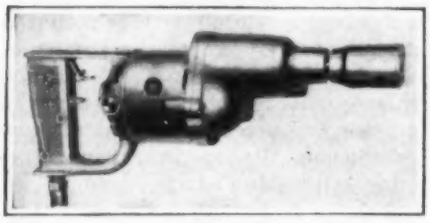
amount of unbalance statically is automatically indicated in ounce-inches.

The machine is made in various sizes to balance parts ranging in size from a small part weighing a few ounces to heavy turbo wheels.

"United States" Nos. 1 and 2 Portable Tappers

The United States Electrical Tool Co., Cincinnati, Ohio, is marketing a portable electric tapper in two sizes, Nos. 1 and 2. The motors are universal and will operate on either director or alternating current.

The mechanism in the tapper is designed so that the chuck automatically reverses when the operator gives a backward pull on the handle. During the tapping operation this clutch has a positive engagement, but upon reversal the engagement is by friction clutch. This feature is said to eliminate tap breakage.



"United States" No. 1 Portable Tapper

Waterston Drill-Grinding Gage

The drill-grinding gage shown in the accompanying illustration is being marketed by J. M. Waterston, 427 Woodward Ave., Detroit, Mich. It is for use in checking the grinding of drills up to 1½ in. in diameter. The lip is graduated in sixteenths with larger divisions at the eighths. These divisions are for comparative purposes only.

The device is made of polished steel. Its length is 4½ inches.

Waterston Drill-Grinding Gage

Trade Catalogs

Hobs and Milling Cutters. Barber-Colman Co., Rockford, Ill., has published its catalog G containing a complete list of standard milling cutters and hobs listed in accordance with simplified practice recommendations of the U. S. Dept. of Commerce. The catalog contains one hundred and twenty-eight 5½x7½-in. pages and is profusely illustrated with photographs of the various types of cutters. It is completely indexed. Brief descriptions and specifications are also given of the machine tools made by this company. Useful information on cutting speeds, gears, prime factors and kindred subjects is appended to the regular catalog section.

Motors, Direct-Current, Totally-Enclosed, Fan-Cooled. The General Electric Co., Schenectady, N. Y., has issued a leaflet on its type CD, totally-enclosed, fan-cooled d.c. motors. Construction of the motor is explained with the aid of a cross-sectional view. A list of ratings is given.

Motors, Electric. The Ohio Electric & Controller Co., 5,900 Morris Ave., Cleveland, Ohio, has published its bulletin No. 205. Construction of both the a.c. and d.c. motors is explained in detail, with the aid of numerous photographs and line cuts. Dimensional data and specifications are given.

Recording Instruments. The Brown Instrument Co., Philadelphia, Pa., has issued a large illustrated leaflet describing its various types of recording instruments, such as pyrometers, flow-meters, thermometers, pressure gages, and so on. Eight patented features are stressed by way of a short description and an illustration of the particular point.

Speed Reducers. Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has published Catalog 100 on its IXL Continuous-Tooth Herringbone Speed Reducers. The advantages of herringbone gears are first cited, then the three types of speed reduction units, single, double and triple are presented with rating tables, the use of which is explained on another page. A page is also devoted to lubrication instructions, and a brief summary of other speed reducers made by this company is also given. The catalog contains sixteen 8½x11-in. pages and is well illustrated by means of halftones and line cuts.

Steel, Nickel. The International Nickel Co., 67 Wall Street, New York City, has published a leaflet on nickel steel. Numerous examples are illustrated where the requirements are for a metal that has hardness with toughness and resistance to wear. Four examples are also given of typical applications where resistance to high stress is paramount. The bulletin is well illustrated.

Tools for Turret Lathes. The Gisholt Machine Co., Madison, Wis., has issued a 36-page catalog on its standard tools for small turret lathes. The contents are classified as follows: chucking tools, bar tools, chuck adapters, face plates, collet chucks, chucks, die heads, collapsing taps, and collets. For each tool a photograph is shown together with a line cut illustrating a typical operation. A brief description of the tool and its purpose follows, together with complete specifications and dimensional data. The catalog is indexed both alphabetically and numerically.

Universal Joints. The Mutual Machine Co., Hartford, Conn., has published a list of stock sizes and prices on universal joints for use on machinery.

Welding, Arc, of Structural Steel. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., announce Special Publication 1767 on the arc welding of structural steel. This publication is designed to give the results of all tests on welded and riveted structural members made by this company during the past few years. The method of making the welds in general is first described, then the result of each test taken up in detail. In each case the appearance of the tested pieces after failure is shown by means of photographs. Numerous charts are also included. Results are then summarized in a brief form. Arc-welding equipment made by this company is also described in brief.

Pamphlets Received

Group Drives. Chas. A. Schieren Co., 37 Ferry St., New York, N. Y., is distributing a reprint of an article by L. H. Hopkins, entitled "Group Drives More Economical For Most Conditions." Among other factors the author discusses the effects on power factor, maintenance costs, and standardization obtained through the use of group drive. Condensed opinions of five prominent engineers are also appended.

Heat-Resisting Alloys. The Southern Manganese Steel Co., 6600 Ridge Ave., St. Louis, Mo., has printed a 28-page booklet, loose-leaf style, of Lefax size, on the above subject. It consists of notes on the selection, design, and use of castings for high-temperature service. Chemical resistivity at high temperatures is first discussed, followed by notes on strength at high temperatures, thermal expansion and contraction, specific heat and heat content, heat-transfer properties and electrical properties. The treatment is entirely technical in character. The text does, however, concern itself largely with the properties of "Fahralloy," a metal made by this company.

News of the Week

Modern Welding and Cutting Discussed at Convention of Acetylene Association

W. A. Slack is elected president

A large attendance and the presentation of a group of well-balanced papers marked the twenty-seventh annual convention of the International Acetylene Association held at the Congress Hotel, Chicago, Nov. 10, 11 and 12. In arranging the program this year, the committee in charge purposely reduced the number of papers usually given at the annual convention, the thought being that greater benefit would be derived from the meeting if less papers were read and more discussions held. With this thought in mind, the program committee prepared an excellent series of papers that were of vital interest to the acetylene industry.

W. A. Slack, of the Torchweld Co., was elected president for the coming year. David Duncan, of the Carbolite Co., was chosen vice-president and Secretary Morrison was re-elected. New directors are R. A. Sossong, the Air Reduction Co., and C. A. McCune, the American Chain Co.

One of the outstanding features of the convention was the address made by Dr. Gerald Wendt, director of industrial research, Pennsylvania State College. Dr. Wendt dwelt on the remarkable progress made by the oxy-acetylene industry, and mentioned the possibilities that lie in the future, including the manufacture of fertilizer from carbide, and synthetic chemicals from acetylene.

The papers presented during the convention were: "Use of Welding on Naval Vessels," by Commander H. E. Rossell, Construction Corps, U. S. Navy; "Selection of a Welding Process," by L. E. Everett, Nugent Steel Castings Co., Chicago; "Testing of Welds," by Dr. H. L. Whittemore, Bureau of Standards, Washington, D. C.; "A Few Factors to be Considered for Accelerated Progress of the Gas Welding Industry," by Dr. A. Krebs, General Welding and Equipment Co., Boston, Mass.; "The Most Important Thing in Welding," by S. W. Miller; "Does Oxy-Acetylene Welding Suffer from Defective Welding by Other Processes," by G. O. Carter; "Production Welding on Steel Furniture," by M. F. Bayer, Simmons Co., Kenosha, Wis.; "Some Applications of Bronze Welding," by W. C. Swift, American Brass Co., Waterbury, Conn.; "Heat-Treatment by the Oxy-Acetylene Flame," by E. E. Thum; "How the Moving Picture Is Educating the Public and the User," by G. E. Harcke, Air Reduction Sales Co.; and "Underwater Metal Cutting," by L. F. Hagglund, Underwater Metal Cutting Corporation of New York City.

Reports were received from the portable apparatus and marine lighting committee, house-lighting committee, membership committee, resolutions committee, and the consulting engineer for the association.

In his address, President Sossong said that during the past year, the oxy-acetylene industry has enjoyed the most profitable year of its history. The production of acetylene and oxygen has far surpassed the fondest dreams. This association primarily was organized to take care of the needs of the house-lighting interests but the use of acetylene with oxygen for welding and cutting became so general that it has been necessary to devote a greater part of the association's activities to that industry.

Four Avenues of Progress

"One of the things it has been my pleasure to have instituted this year," said Mr. Sossong, "was that of dividing the oxy-acetylene committee into Eastern and Western sections, with a vice-chairman of each section reporting to the chairman. During the last year, four distinct subjects were presented, namely, the possibility of standardization of tip sizes of oxy-acetylene torches; the standardization of welding rod sizes; standard tests for the purpose of determining qualifications of oxy-acetylene welders; and the preparation of bulletins covering the physical and chemical properties of oxygen and acetylene.

"One of the very gratifying things noted during the past year is the few accidents reported in spite of the fact that the production of gases were the greatest of any previous year. This condition illustrates the complete cooperation of the members of this industry of availing themselves of all well-known safety first practices."

In his paper on bronze welding, Mr. Swift said: "Bronze welding, as now known, is the logical development of the old time process of brazing. A properly made bronze weld will have greater strength than the cast iron itself. It is to be expected that a specimen welding with first quality bronze and tested through destruction, would not break through the bronze, as this metal has an ultimate strength greater than cast iron.

"It should be recognized immediately that for some types of repair work on cast iron, bronze welding is not adaptable. When colors must be matched, for instance, or where certain kinds of finishing or enameling are to be done, it is better to weld with cast-iron rods. Welding with bronze, however, can be used for repair work on rough machinery, on small parts and especially on light sections where preheating would be awkward or undesirable. Automotive repair shops frequently use this method to repair cracked cylinder blocks without dismantling the motor. Bronze is used in many instances to build up new teeth from broken gears.

"The cost of bronze welding under average conditions, will be less for a given piece of work than welding with cast-iron rods. There are important savings of time, preheating costs, and gases, that offset, to some extent, the fact that the bronze welding rod costs a little more than the cast-iron rod."

Mr. Thum in his paper covered the use of the blowpipe in connection with the spot hardening of steel and malleable iron, softening hard spots on castings, and tempering or annealing heat-treated parts. He said: "The proper application of the oxy-acetylene flame to the local or spot hardening and annealing of many metals, closely conforms to the principle of modern metallurgy. Heat-treatment by the oxy-acetylene flame does not include the firing of furnaces with acetylene gas nor does it include case-hardening. Perhaps the most obvious use of the oxy-acetylene flame for heat-treating is for emergency hardening of small metal cutting tools such as lathe tools, milling cutters and drills. Every machine shop has facilities for hardening tools, but suppose it is necessary to prepare two or three tools in a hurry. The furnace or forge is cold and it takes time to bring it to heat. Instantly the oxy-acetylene flame is at full heat and the cutting edge of the tool may be brought to temperature gradually by brushing the flame back and forth. At the correct time, the tool is plunged into water and the job is done before the forge fire could be lighted.

"Other items in emergency work frequently made may be done with economy and dispatch. Often it is desirable to case-harden only parts of surfaces. For instance, cam roller pins must be hard in the body to resist wear and the end soft enough to be riveted into a tappet. Partial case-hardening of this nature is common. Dies for drop forging, stamping or punching usually are formed of a good sized piece of fine steel and then carefully hardened. It is frequently desirable to draw this temper of the under side in order to toughen the block against the working shocks. For this class of work, the die may be partly immersed, face downward, in a little water and the back brushed steadily with an oxy-acetylene flame until it has been properly tempered."

Westernization of Japan Bringing Change in Textile Equipment

Americans certain to get their share of business

BY OUR TOKIO CORRESPONDENT

The kimono, until a few years ago the almost universal clothing of Japan, is passing with astounding rapidity. Today it is difficult to tell whether more male city dwellers are dressed in foreign clothes or kimono. Even the women are gradually changing, although with them the movement has just started. This step in the Westernization of Japan is changing the character of the woolen market and, incidentally, the character of the machinery which manufacturers require.

For some years the manufacturers of muslins, largely used for winter kimonos, did very well. The tremendous slumps in the prices of wool which have marked recent years, however, brought them financial difficulties from which they are just emerging, and the change in the fashions of men's clothes have forced them, reluctantly, to start about the replacing of their equipment.

DEMAND FOR KNITTING MACHINES

Muslin companies are heavily overspindled and the market is running away from them. There seems slight likelihood that the demand for muslins will ever be what it was in the past. In its place has arisen a demand for knitted woolen underwear, which is being used in greater quantities every year. Textile machinery agents here report many inquiries regarding wool knitting installations.

Davis, Furber & Co., the Whitin Machinery Co., Saco-Lowell and Crompton-Knowles are all represented here and they or other American concerns seem certain to get a share of the new woolen mill business. Machinery experts assert that Germany is sure to be favored, as many companies are already equipped with machines of German make and will wish to have the advantage of interchangeable parts. For low hosiery counts British machines will probably be required.

While rayon is going ahead by leaps and bounds, most of the orders for the little machinery required have been placed already, principally with German makers.

Due to the law prohibiting late night work for women and children, which becomes fully effective in July, 1929, cotton spinners and weavers are already starting to increase the number of their spindles in order to keep the cut in hours from reducing production. Here British machines are largely favored, although some American makes are represented.

The principal complaint heard here regarding American machines is that the United States makers will not alter their specifications to suit Japanese needs, as is done in Britain and Germany. The Japanese worker is much shorter than the American and cannot attain a high standard of efficiency on the tall American machines. A further objection is that American machines are built far too heavily for Japanese requirements. A British textile machinery expert told your correspondent that he recently had to go over one American-made machine and cut 56 lb. out of the balance.

Textile and textile machinery men are watching the Chinese war situation with interest. When hostilities cease, they declare, China will be a rich field. The internal troubles have now been in progress for 14 years and the hinterland is literally starving for all kinds of goods from the seaboard. With the situation so unsettled as it has been, deals in the treaty ports have all been on the cash in hand basis and naturally this has stifled trade. Interior points have no stocks and Japanese, British and American concerns are known to be studying the situation and it would not be surprising if the coming peace to China should be attended by the founding of a woolen textile industry in Shanghai.

Peace in China, however, is still a matter for speculation. Apparently the only salvation of the country is that the militarists, like the Kilkenny cats, will "eat each other up." Observers, however, see a faint ray of hope on the horizon at present.

The present business condition of Japan is spotty. Cotton yarn and textiles are seriously affected by the Chinese disturbance and by the steady decline of bar silver. Stocks of raw silk are piling up in Yokohoma and the New York demand, in view of the recent sharp recessions in Wall Street, is again the subject of doubt. In the last two weeks spot and futures prices have receded.

The Bank of Japan has lowered its discount rates for the first time since April, 1925, dropping them from 2 sen per 100 yen per day (7.3 per cent per annum) to 1.8 sen (6.57 per cent). This was expected to bring about a revival of business, but the banks and trust companies have refused to reduce their interest rates on deposits, for fear of losing funds to each other and to the securities markets, and business has returned to its former pessimistic level. The Finance Ministry has removed the ban on imports of foreign capital, however, and it seems extremely likely that the banks and trust companies will be forced to make reductions in the course of the next few months, bringing about an enlivening of business. Rates are now very high. Trust companies are guaranteeing a minimum yield of at least 7 per cent.

Building lines, however, are doing rather well. Flour is looking upward under the influence of a merger of the two largest mills, the Dai Nippon and Nisshin, which have united under the name of the former. They are responsible for 80 per cent of the output in Japan. Lumber orders are brisk at medium price levels. Rubber manufacturers and dealers are engaged in their regular price war. Steel prices are rising, as the coal strike has eliminated Britain and demand is increasing for black sheets and bars. The wool market is firm and shows signs of improvement in recent weeks.

Stabilization of Money and Lifting of Trade Barriers Would Help France

Machinery makers attempt co-ordination of effort

BY OUR PARIS CORRESPONDENT

Apart from the ever pressing debt problem, two issues loom large in the economic future of France—the possibilities of the workings of the London bankers' manifesto and the urgent need of stabilizing the value of the franc.

The famous London manifesto has met with but a half-hearted reception in France. The Briand-Stressmann accord of Thoiry as the sequence of the Locarno agreement and the entry of Germany into the League of Nations, as well as the inception of the international steel cartel at Germany's instigation, has developed the idea in certain quarters in France that a working arrangement might be made to advantage with Germany so far as trading with the big and little nations of the Europe of the Versailles Treaty. The danger for France is that this might mean that the smaller central powers would address themselves to Krupps for locomotives and diesel motors while France would have to be content with orders for soap, perfumery and ladies' gowns.

France regards the effects of the stabilizing of the Belgian franc with a certain inquietude, though it is to be noted that in the ten-day interval the French franc itself has appreciably improved its position. The French treasury is hoping to arrive at a basis of revalorization which will be more favorable than that adopted by Belgium.

The experiment will be fraught with some risk, living costs will more nearly approach those of world markets and wages will consequently rise as also will selling prices.

The situation will require a difficult and perhaps lengthy period of adjustment but the outcome in the long run will doubtless be preferable to that which is indicated under the painful fluctuations of the franc as evinced during the past year.

A thesis was developed as a species of industrial propaganda during the Paris automobile show just closed, that automobiles were cheaper in France today than ever before. On a gold basis this is undoubtedly so, but they are not so low priced as the comparative American product in America. The classic small French car selling for 20,000 francs may be now had for

the price of 88 quintals of wheat, whereas, at the price per quintal of before the war (25 francs as compared with 240 francs today), there were no automobiles on the French market at the value of 88 quintals of wheat, say 2,200 francs.

The Association of Machinery and Machine Tool Makers is pursuing a series of conferences and discussions chiefly concerning conditions of sales and payment, which, it goes without saying, are largely contingent upon the terms which are granted, or may be granted, them by producers of raw and semi-raw materials. There is a noticeable effort on all sides in the metallurgical and metal fabricating trades towards a co-ordination of effort, but as yet to nothing like the extent which is to be found in the American industry.

The machinery and tool trade is manifestly quiet for this season of the year, plants are only barely active and while orders for future delivery are needed the difficulties of provisioning in raw materials and the delays consequent upon deliveries are still holding out uncertainties as to the stabilizing of the price scale. Colonial export markets are reported satisfactory, more so than foreign world markets where the competition of the United States, Germany and Great Britain is felt more keenly than ever in many lines.

The stamping presses of the east of France are well supplied with orders for railway and building specialties, but general building and construction elements of metal are quiet in demand.

Drawn wire and wire products are finding orders even at increased prices. Rumors of an international cartel in this line, including as well wire nails, appear to be premature though the desirability of uniformity of price in world markets is unquestioned if there is to be a fair division of world business among European makers who have proposed still another economic alliance like unto the steel cartel.

The tool trade in most branches is handicapped by delivery delays of raw material. France, since the war, has acquired a considerable export market in many lines of small tools where in other instances it has failed totally. Hand tools are meeting with difficulties. A number of wood-working tool makers are co-operating in placing orders for raw materials and are joining hands in raising prices of the items on their lists from 10 to 40 per cent. World prices will one day become the interior figure in France where if certain items are inordinately high priced others are ridiculously low, the average indeed is too low if a new and higher wage scale is to be met as is anticipated.

At the base of everything is the state of the metallurgical industry in France. There were 153 blast furnaces in operation on Oct. 1, 30 ready for operation and 34 under repair. In addition to nearly seven million metric tons of pig iron produced since the first of the year there were 30,000 tons of iron produced in electric furnaces as well as 60,000 tons of electric steel. The showing is considered remarkable.

Nine months imports from the United states increased over last year to the value of a million and a half francs. This was more than imports from Great Britain or Germany, though the later more than doubled over the figure of last year. Exports to the United States were valued at 2,747,080 francs which was half a million in excess of last year.

Total French imports for the nine months of materials necessary to industry were valued at 29,996,243,000 francs which was an excedent over 1925 of well above ten billion francs. Exports of manufactured goods amounted to 11,790,733,000 francs, a virtual increase of three billion francs.

A curious comparison is that while imports fell off 343,702 tons their value increased 14,742,174,000 francs, due to the steadily falling value of the franc for the major part of the period in question. In July, August and September exports showed an increase in value.

Business Conditions Are Sound and Industrial Activity Will Continue

Steel manufacturers and metal trades are ahead of last year

"Present business conditions are sound, and indications are that industrial and commercial activity on the whole will continue at a satisfactory momentum, as far as the immediate future is concerned." That is the composite judgment of leading industrial and financial executives of the country, as expressed in a recent survey issued by the National Industrial Conference Board of New York.

Increasing stability is the outstanding characteristic of the business development during the past five years, according to the analysis of conditions, and the achievement of this condition, is ascribed in large measure to the improved technique of distribution, the better organization of our credit and transportation systems, the steadying influence of the Federal Reserve system, and to better informed and hence more alert industrial and business management.

Characteristic of the new orientation of business is the emphasis placed by the conference board on the importance of a prosperous working class. The generally accepted view, that good labor conditions depend on good business conditions, is characterized by one member of the board as superficial. "The reverse is true," according to this industrialist; "it is the experience of myself and of my associates in our industry that good business conditions are based upon good labor conditions."

It is pointed out as significant that business activity has not diminished but rather increased with the tendency of declining prices underway during the current year. The lower prices are a symptom of greater economy in production and distribution and of credit economies and, together with the prevailing high wage levels, have resulted in the United States in the highest purchasing power of wage earnings ever known. "Real weekly earnings" are now about 29 per cent higher than in 1914, 9 per cent higher than in 1920, and nearly 1 per cent higher than a year ago."

Other authentic business reports give some interesting facts on current conditions. While unsold pig iron stocks were accumulating early in the year, they have been moving since, and prices are hardening. The industry has been suffering some from foreign competition. Sixty per cent of the merchant furnaces are in operation, which indicates that general business is just about normal.

The steel industry, on the other hand, which produced 44,000,000 ingots during 1925, for the first nine months of the current year has been operating on a basis of 48,000,000 ingots, approximately, the greatest production in its history.

Activity in the metal trades industry may be judged by the fact that the number of wage earners in the factories has been increased by about 10 per cent during the year, while the productivity of the industry per worker has been increased considerably. There have been practically no labor disturbances in the more than 1,100 plants reporting during the past year. Activity in the machine-tool industry closely parallels that of the metal trades.

With the exception of seasonal let-up, and a moderate slowing up of sales ascribed to unseasonable weather during a large portion of the year, the automobile industry has recorded no unfavorable factor. While the credit situation was declared to have been over-expanded somewhat in 1925, this condition has been corrected by the general adoption of requirements for larger first payments and for a limit of 12 months in which to pay the entire amount. Total production of passenger cars, trucks and buses in the United States and Canada during the first eight months of this year exceeded that of the corresponding period in 1925 by 14 per cent.

Skoda Works Enters Airplane Field

A contract for the establishment of an airplane factory near Warsaw has been signed between the Skoda Works, of Prague, Czechoslovakia, and the Polish government. After the ratification of the contract by the government of Poland a joint stock company will be formed under the name "Aeroplane Factory of the Skoda Works in Poland" which will take over the former airplane factory "Francopol," founded by French capital and later owned by French and Polish interests. The new company, in which the government will be financially interested, will be fully controlled by the Skoda Works. As soon as the most urgent reconstruction work is completed it is planned to start manufacturing airplane motors of the type "Lorrain-Dietrich."

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

LAST Thursday the United States celebrated the eighth anniversary of the Armistice with complacency. The intervening years have passed so swiftly that it is hard to realize that the post-war generation knows but little of pre-war conditions and that the younger business men of today have had no experience of the hard times with which American prosperity was punctuated prior to 1914.

As a result, a new school of economists is growing up. Its adherents maintain that our wealth is now so great that we can absorb anything less than a cataclysmal shock and that in the Federal Reserve System we are provided with a gyroscope that will keep the ship of business on an even keel however rough the sea may be.

Contemplating the recovery that has taken place since November, 1918, it must be admitted that there is much to justify this new philosophy of optimism, and the week's record indicates that it has been embraced by many. Perhaps the most impressive evidence of its acceptance is to be found in the stability of the cotton market, where prices yielded hardly at all upon a government estimate which put the prospective crop at nearly 18,000,000 bales. When one thinks what effect such an estimate would have had fourteen years ago the change that has taken place in the interval may be partially realized.

The triumph of psychology over fact that it connotes is chiefly due to the publicity that was given to cotton and it is a lesson in the value of advertising that every business man should heed and lay to heart.

Advertising is, in fact, a force whose power was but little understood before the war and it is only by its use that we have been able to find buyers for the greatly increased production of the last few years. The apparent ease with which this has been accomplished and frequency with which the saturation point has been moved forward into the constantly receding future are reflected in the large earnings that many industrial corporations report and a stock market in which values have been maintained despite the seemingly high prices at which many securities are selling.

But while distributive trade is good and car loadings are the largest on record, a few contrapuntal notes are to be heard from time to time. One is the continued though slight reduction in building activity. Another is a small decline in bank clearings. Still another is the delay that the proposed railway consolidations seem to be encountering, and the last, though loudest, is the plaint of the farmers in the West and the South.

None of these things can yet be regarded as positively adverse, but they are negatively restraining and will probably prevent any speculative outburst at least until the 69th Congress has met and adjourned *sine die* as it must on the fourth of March, 1927. Then we will enter upon nine months of political quiescence during which much will be forgotten and many things may happen.

What's Doing in Industry

Conditions in the machinery and machine tool field are best characterized as "spotty." More than one important industrial center reports a slackening of business volume, while one or two report an increase. It is evident that only replacement buying will take place between now and the end of the year.

The larger automobile manufacturers in the Detroit district are marking time until after the show, and hence there has been a further decline in business in that territory. Chicago reports renewed activity with widespread demand for a variety of equipment. A small but nevertheless substantial increase in sales in the Cincinnati territory has made the outlook very promising. November sales are ahead of October sales in Indianapolis and prospects are bright for the remainder of the year.

Little change is reported from New York, where business is to be had only after arduous seeking. Most of Canada's buying for this year has been done, but there are some large engineering enterprises in the making which promise much early in 1927. Some buying by railroad and textile interests is reported from the South. A large government order placed last week in the New England territory has revived hopes of further industrial activity.

Stability of commodity markets and a financial situation that appears sound lends a feeling of security to general business. Caution, however, continues in many trades and industries.

Meantime the very dearth of sensational news in the business columns of the newspapers is an encouraging augury and there is nothing in sight that suggests any immediate change in the general price level or any check to normal business.

According to a recently issued report of the Treasury, there were only 259,808 persons in the United States who returned incomes of $10,000 or more in 1924. But from the crowds of spenders that are to be seen in New York one would think that the whole 259,000 were in that city, and if the Treasury figures are correct there must be many who are living beyond their incomes. This is what gives the conservatives pause, for they know that the day of reckoning must come sooner or later. Therefore, the Christmas trade should be closely watched, for if it affords any indication of voluntary or enforced economy it may signal the retrenchment that is already overdue.

In the commodity markets the price changes that have been recorded are neither important nor significant. Wheat has fluctuated within narrow limits. The government report on corn shows some decline both in quantity and quality, but it was without much effect. Sugar awaits the announcement of what President Machado will do by way of limiting next year's Cuban crop, but the position otherwise is growing stronger.

Coffee has been dull. Speculation in it has been killed and roasters buy only from day to day. The demand for steel is fair but the automobile production is showing a seasonal decline. Some say that fewer cars will be sold next year, but that has been said so often that no one pays any attention to it.

A further improvement in the shoe trade is to be noted, but men's hats, clothes and the wool out of which the latter are made are not being bought so freely.

A world wide scarcity of coal, and high prices, are reported. The British coal strike is the cause. Its settlement is rumored and contradicted almost every day, but there is no doubt that the miners are going back to work here and there.

Ocean freights are a little lower because the Shipping Board has put about 75 idle steamers into commission. The French government seems to have the price of the franc pretty well under control, but whether this means stabilization at three cents and a settlement of the debt due the United States, remains to be seen.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Southern District

While machinery and tool business in the Southeast is still being adversely affected by the low cotton prices, with sales less than the trade had looked for this fall, it is interesting to note that Georgia and east Tennessee sales are close to normal because of the fact that the agricultural industry in those two states practiced crop diversification on a wide scale this year and is therefore not in nearly as low a financial condition as the industry elsewhere in the South.

The textile industry is now buying fairly well for new plants that are being constructed in this territory, and bids fair to continue a good buyer through the winter months, with the outlook considered very good for the early part of 1927. The lumber and furniture industries have not been buying lately, however, and sales to this source are reported the lowest they have been in several months, with no good sales reported the last four or five weeks by Atlanta dealers. The same is true of brick machinery, principally because the brick manufacturing industries have been having poor business for two months.

Railroads are still fairly good buyers of heavier equipment for shop and similar use, and are still carrying out considerable new construction in this district. Smaller machine shops are buying very little, and what they are buying is in the used or rebuilt market almost entirely. Garages and service stations continue good buyers both of new and rebuilt equipment, but are not as active as a month ago.

New England

The award of the contract for 200 "Wasp" airplane engines and parts, aggregating $2,000,000 to the Pratt & Whitney Aircraft Corporation, of Hartford, during the past week, gave a war-time flavor to the machinery industry of the New England territory. It also explains some of the expansion of activity in the Pratt & Whitney operations recently, but what is more important it forecasts further broadening of production. In view of other prospective business Hartford appears to be situated for a continued period of good business.

Special machinery business is more active and several plants are declining consideration of contracts because of the volume of orders on hand. An improvement in business with South American countries is the subject of comment. European orders for production machinery are numerous. Small tools are selling well. No changes in prices are being considered. Collections are good.

Indianapolis

While there has been no particular change in the volume of machine tool and machinery sales here, the number of inquiries being received is encouraging, according to local manufacturers and dealers. November thus far has been better than the same time last year and is a little better than the first two weeks of October. On the whole, the trade is rather optimistic.

At the present time one of the best customers appears to be the automotive field. Factories in South Bend, Newcastle and Indianapolis and Auburn all report a heavy volume of orders and are ready purchasers of tools. The local Marmon plant is completing a new "Eight-in-a-Row," which will be moderately priced to compete with other cars of that class, and expects to have the car ready to go into production by mid-winter. Tests already are being made on the new job and it will be displayed at the New York show. Officials of the plant believe its production will mean considerable more tooling at the plant.

A good tool demand continues to come from the farm implement factories, which now are increasing their production against early spring deliveries.

Machinery demand appears to be confined mostly to the furniture factories, the coal mines and the brick yards. Special woodworking machinery also is finding some demand with the lumber yards of the state, which are improving an off season to make replacements and new installations in preparation for spring. Machinery demand from the coal mines is exceptional, particularly from the bituminous mines.

Chicago

The renewed activity in the machine tool market, reported during the last days of October, is being well maintained. Dealers in both new and used machinery are practically unanimous in the belief that the month of November will produce a volume of business in excess of that of October. In no instance, it is said, is this increased activity due to the buying of tools by any of the big specialized industries. Rather, it covers a wide field of general industrial production throughout the Middle-West.

Factories which up to recently have been operating on a part-time basis seem to have been speeding up, in many instances to capacity; machine shops are busy, locally, and in the surrounding territory, the results of this renewed activity being reflected in the machine tool market. The demand for new machinery has been stimulated within the last few weeks.

The call for used tools, particularly punch presses, grinders and millers, is keeping dealers alert to procure for their customers such tools as are in particular demand, at satisfactory prices.

None of the important lists heretofore referred to as having been issued has as yet been closed, so far as can be learned. Such buying as is reported from railroads and other big interests consists of single tools or small lots. It is the consensus of opinion among machinery men that business will continue on a satisfactory basis for at least three weeks to come.

New York

There has been no noticeable change in the complexion of the machinery and machine tool market in this territory in the past week. If anything, it might be said that activity has shown a tendency to slow up. Agents here report that there is enough business to be had, but that it must be sought after with greater persistence than has been the case in the immediate past.

Manufacturers of electrical goods, hardware and similar small products have been in the market for automatic punching and forming machines. These orders are for small quantities but they help to keep up a satisfactory volume. It is reported that the General Electric Co. has closed orders for a large quantity of automatic machinery for use in the proposed refrigerating machine plant at Schenectady. A few of the larger automobile manufacturers came into the market for equipment, but this was for urgently needed replacements. The crane and hoist dealers report good business, production being guaranteed for at least three months.

The second-hand tool market is slow, it being the opinion of many that buyers are stretching their expenditures to take up new equipment, rather than pay what they consider high prices for used tools.

Canada

There is little change in the metal markets of the Dominion. The bulk of the buying appears to be done for this year, but much new business is promised for the early months of next year, particularly from the railroads.

The iron and steel mills are well employed. Considerable business is being received from the pulp and paper industry. Steadily expanding production of fabricated steel, machinery and electrical equipment in many plants is traced directly to the paper industry. It is reported that one structural steel plant in Montreal has two years' work under contract. Another Montreal firm producing paper machines has had orders for eight of these huge units.

September production of 16,953 automobiles marked an increase of 11 per cent over the 15,261 machines produced in August. For the first nine months of the present year, the cumulative production was 172,300 cars, trucks and chassis valued at $105,560,838, an increase of 35 per cent in number and 27 per cent in selling value over the output of the corresponding period last year.

There is a heavy building program in sight. In October, construction awards rose to $43,384,600, which is not only a 40 per cent increase over October, 1925, but also constitutes a record for all previous October awards

Detroit

Further declines in the sale of machinery and machine tools in Detroit and other automobile centers in southeastern Michigan are reported by representative dealers in this city.

One of the largest machinery firms doing business with automotive plants reports that sales for October were the lowest of any month during the present year, and that business during November is at least 40 per cent under that of last month. The same falling off in business is reported by other firms in Detroit.

According to a survey of local dealers most of the automobile plants are withholding orders for new equipment until the first of the year. One firm reports five or six sizable orders for machinery which will not break until automobile show time.

Sales are scattered and are confined to no particular industry. This is the single encouraging feature in the market at this time. Inquiries are frequent, but the actual orders are few and far between.

Of the local plants Packard and Hupmobile seem to be moving along better than any others. Both are buying machinery and tools. Cadillac, which had been purchasing considerable is easing off, while all the popular-priced cars are below peak production.

Employment is nearly 50,000 under the figure reached a year ago, but the fall of 1925 was the banner year for employment in Detroit and hence not a normal year.

Cincinnati

Machine tool manufacturers and selling agents in Cincinnati report a further increase in demand in the past week. Taking everything into consideration, market conditions are regarded as satisfactory and of an encouraging nature. While no great quantity of orders has accumulated, enough came in from day to day to keep business active.

Several manufacturers reported the receipt, of a number of urgent orders coming by telegraph or telephone, a fact that is regarded as clearly indicating a sudden increase in the activity of machine tool users. Inquiries came from all sections. Three railroads, the C. & O., the N. Y. C. and the N. Y., N. H. & H., sent in small lists of requirements.

It is freely predicted that some large buying of high-efficiency tools is about to be done by automobile manufacturers, to replace present equipment. This prediction is based on the fact that competition has become so keen in the automobile field that the utmost manufacturing economy has become imperative.

The greater part of the week's business consisted of orders for single tools and replacements, coming from all sections and from all kinds of users, the purchases being well diversified in the matter of size and type.

Engineering Council Devises Plans for U. S. Department of Public Works

Would replace Department of Interior and many bureaus

A national committee of engineers, after two years of study, has devised a plan to revamp the administrative structure of the United States government so far as its engineering functions are concerned, it was announced at a meeting of the American Engineering Council at Cornell University on Nov. 11. Enactment of its recommendations into law would, it was declared, mean a big reduction in the cost of the government's engineering projects, upon which many millions of dollars are spent.

The committee, in a report adopted by the administrative board of the council at the opening session of a two-day meeting attended by leading engineers from all parts of the country, proposes the establishment of a Department of Public Works and Domain to replace the Department of the Interior.

The plan makes a complete regrouping of Federal public works activities. More than a score of bureaus, boards, departmental agencies and services are incorporated organically into the new department. Numerous other units are so adjusted that they can be served in their public works aspects by the Department of Public Works and Domain, which in this respect would act as consulting engineer and in which all government effort appropriate to its sphere would for the first time be brought under centralized control.

Every function and activity of the Federal government that has been, or might be, seriously considered for allocation to such a department was studied by the committee, it was stated by Dexter S. Kimball, dean of the Cornell College of Engineering, president of the council.

Dean Dimball characterized the report, prepared by a committee of which E. O. Griffenhagen, of Chicago, is chairman, as an influence which would penetrate the whole problem of government reorganization.

Some of the Units

The committee recommended that the following units be included in the new department: Geological Survey, Bureau of Reclamation, the Alaska railroad, National Park Service, General Land Office, all of which are now in the Department of the Interior; Bureau of Public Roads and Forest Service, now in the Department of Agriculture; the non-military river and harbor work of the office of Chief of Engineers, Board of Engineers for rivers and harbors, Mississippi River Commission, California Debris Commission, Supervisor of the Harbor of New York, the Northern and Northwestern Land Survey, Board of Commissioners for Alaska and the Alaska telegraph and cable system, all now under the Department of War.

The committee also urged that a program and a schedule be worked out between the two Cabinet officers, the Secretary of Public Works and Domain and the Secretary of War, that will give practical effect to a more comprehensive plan for the training of members of the corps of engineers of the United States Army in responsible engineering work in a much more varied field than the river and harbors work to which they have been limited.

Striking economies of many kinds, direct and indirect, can be accomplished in the interest of the taxpayers by the adoption of this plan, the committee declares.

The American Engineering Council, Dean Kimball announced, will seek the support of other organizations, including architects and contractors, in an effort to have the principles of this plan enacted into law at the coming session of Congress. The public works legislation proposed by the engineers, will be in charge of Senator Jones, of Washington, and Representative Wyant, of Pennsylvania.

Navy Places Order for "Wasp" Aircraft Engines

Announcement has just been made from Washington of the award of a contract to the Pratt & Whitney Aircraft Co., of Hartford, Conn., for the purchase by the Navy Department of a quantity of "Wasp" aircraft engines. It is understood that the contract includes 200 engines and a large quantity of spare parts, making a total of more than two million dollars.

The "Wasp" engine successfully passed the exacting Navy requirements test last January. The completely equipped engine weighs less than 650 lb., and is rated for service at 425 hp.

The "Wasp" is an air-cooled radial type engine, and through exhaustive flight testing proved to be superior to the water-cooled types of engines.

The engines which will be furnished under the new contract are to be used exclusively in single-place fighting planes.

Officials of the Pratt & Whitney Aircraft Co. stated that present contracts would keep their plant busy throughout all of 1927. These operations will require more than 200 employees, nearly all of whom consist of the most skilled type of workmen. The officials also stated that in addition to their military program, it was believed that the "Wasp" engine would be equally adaptable to commercial requirements.

Transportation Meeting of S.A.E. at Boston

Many aspects of passenger and freight transportation by motorcoach and motor truck fleets were dealt with in five technical sessions at the three-day transportation and service meeting of the Society of Automotive Engineers, held in Boston Nov. 16, 17 and 18.

Addresses by more than a dozen authoritative speakers gave interesting and useful information on the operation of motor coaches by the New Haven R.R. and motor trucks by the Boston & Maine R.R., the handling of freight by trucks at railroad terminals, the use of removable freight containers for hauling by highway and rail, the economics of co-ordinated transportation by motor vehicle and electric and steam railroad, fleet management, the merchandising of motor truck transportation, standardization of motorcoach equipment and its successful maintenance, maintenance tools and fixtures in service stations, the relation of truck tires to the vehicle and the road, the importance of tire service, and the effect of brake drum heat on motorcoach tires.

E. P. Warner, Assistant Secretary of the Navy for Aeronautics, was toastmaster at the banquet held in connection with the meeting at the Copley Plaza Hotel.

Continental Motors Ready With Single-Sleeve Valve Engine

The first public announcement of what is considered an important advance in automotive engineering was made on Nov. 15 at the monthly meeting of the Metropolitan Section, Society of Automotive Engineers. At this meeting, which was held at the Hotel Woodstock, New York, W. A. Frederick, chief engineer of the Continental Motors Corporation, Detroit, described a single-sleeve valve engine which his company has been developing for nearly two years. Double-sleeve valve engines are now being used on important designs of passenger automobiles and motor buses, but the single-sleeve type is new here, although the design is based upon a Burt-McCollum engine used in the Argyll, a British made automobile, just prior to the World War.

Such parts as the crankshaft, connecting rods, piston, spark plugs, are of the design used in the conventional poppet valve engine, Mr. Frederick explained, but the camshaft and valve gear are replaced by a single valve of tubular form in the new design. Ports are cut at the upper end of this sleeve and in the cylinder, the sleeve being moved up and down and partly turned at the same time so that exhaust and intake manifolds are properly connected to the cylinder.

Lubrication for the sleeve valve engine is made possible by the characteristic twisting movement of the sleeve valve. This causes the oil to be rolled evenly over the entire sleeve surface so that the oil grooves used with double-sleeve engines are not necessary.

Operating efficiency, good power output and silence in operation were given by Mr. Frederick as the chief advantages of a single-sleeve valve engine. He cited a test made on a six cylinder engine of this type which was run for 1,000 hr. at full load. At the end the gears ran as quiet as at the start, and on dismantling the engine, the maximum wear on the piston skirt was only one-thousandth of an inch, while the wear on the outside diameter of the sleeve was undiscernible. The power output was gradually built up during the first 100 hr. until it reached 44 brake power, after which it remained constant.

Personals

W. S. BALLENGER has resigned as treasurer of the Chevrolet Motor Car Co.

P. H. BLISS, vice-president of the Warner & Swasey Co., of Cleveland, returned from Europe on Nov. 10.

E. J. HORNBERGER has joined the sales force of the W. E. Shipley Machinery Co., of Philadelphia. He was formerly chief engineer for Bardons & Oliver, of Cleveland.

P. E. LATTNER, formerly contract engineer for the Minneapolis Machinery and Equipment Co., has resigned and will later be associated with the fabricating sales department of the Wallace Bridge and Structural Co.

ARTHUR B. DOMONOSKE is now professor of mechanical engineering at Stanford University. He was formerly professor of experimental engineering in the shops of the University of California.

J. E. SMITH, for the past seven and a half years works superintendent of the Mansfield Plant of the Westinghouse Electric and Manufacturing Co., has been appointed director of manufacturing methods and machine tool equipment. In his new position, Mr. Smith will be responsible for the study of cost reductions and will assist in the administration of a development program now in effect.

Business Items

The Lufkin Foundry Machine Co., of Lufkin, Texas, has opened a sales office in Tulsa, Okla. W. W. Trout is manager.

The contract has been awarded for the construction of a machine shop for the Ross Gear and Tool Co., of Lafayette, Ind.

The Air Reduction Co., of New York, has acquired a controlling interest in the Commercial Acetylene Supply Co., Inc. A satisfactory transfer has been made in the capital and common stock.

The Super Tools Co., 2033 Park Ave., Detroit, Mich., is considering the establishment of a branch plant at Sheffield, Ala., for the manufacture of a recently patented type of wrench.

The Simplex Wire and Cable Co. announces the removal of its St. Augustine, Fla., offices to the Barnett National Bank Bldg. Miss F. H. Pettee continues as Florida manager.

The United States Pipe and Foundry Co., of Chattanooga, Tenn., has awarded contracts to T. S. Moudy & Co., Chattanooga, for $35,000 worth of crane and hoisting machinery to be installed in the 28th Street plant of the company in that city.

The Taylor Iron Works and Supply Co., of Macon, Ga., manufacturer of castings and machinery distributor in the Southeastern territory, has acquired an entire block on Broadway in Macon where construction of an addition to the plant is contemplated.

An option to purchase the entire assets of the United States Vanadium Co. has been exercised by the Union Carbide and Carbon Corporation, effective Dec. 1. The Union company has been operating the plants of the vanadium company for the past year.

The Joubert & Goslin Machine and Foundry Co., of Birmingham, Ala., manufacturer of sugar refinery and factory machinery, is starting the production in the Birmingham plant of several additional lines of machinery, principally evaporating and drying equipment.

Drying Systems, Inc., of Chicago, designers and manufacturers of drying equipment, announce the acquisition of the National Rotary Air Filter manufactured by the National Air Filter Co., of Chicago. The manufacture, sale and servicing of this filter will now be carried on under the direction of Drying Systems, Inc.

The C. H. Turner Manufacturing Co. has been organized at Statesville, N. C., by a consolidation of the business of the C. H. Turner Foundry Co. and a separate machinery business conducted by C. H. Turner. The company manufactures various lines of machinery, principally a line of saw mills and saw mill equipment.

The Export Screw Association of the United States has been organized and offices have been established at 101 Park Ave., New York. The purpose of the organization will be the exporting of wood screws. Members of the association are: The American Screw Co., the American Hardware Corporation, the Bridgeport Screw Co., the Charles Parker Co., and the Eagle Lock Co.

Obituaries

EDWARD F. ABBEY, president of the Etna Machine Co., of Toledo, Ohio, died in that city on Nov. 8.

CHARLES BRADLEY ROWLAND, vice-president of the Continental Iron Works, Brooklyn, N. Y., died Nov. 1, at his home in Greenwich, Conn. Mr. Rowland was born in Brooklyn 63 years ago. Mr. Rowland was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Society of Naval Architects, and a life member of the New Haven Historical Society.

What the Railroads Are Doing

For the first time since the passage of the Transportation Act, the railroads of the United States as a whole will earn in 1926 a "fair return" on their property valuation, according to a recent analysis made by a railroad bureau.

The year 1926 has so far been a rather disappointing one for railroad equipment builders. In the first ten months orders for locomotives and passenger cars have shown improvement over the corresponding period of 1925, but freight-car buying has been below the rate of last year, which was the poorest in the equipment business since 1921.

Up to Oct. 30 there were 1,061 locomotives ordered, of which 133 were for export. In all of 1925, locomotive orders totaled 1,274 units.

Passenger car buying has shown slight improvement this year, the ten months' booking being 1,148 units, of which 56 were for export, against 1,008, of which 27 were for foreign shipment, in the 1925 period.

Freight-car buying in 1926, to Oct. 30, has called for 48,592 cars, including 866 for export, which compares with 52,291, of which 1,340 were for export, in the 1925 period. Total orders for all of last year embraced 95,596 freight cars, showing that considerable buying of this class also occurred in the closing months of the year.

Equipment orders of the past week included 100 flat cars for the Chicago & North Western, placed with the Bettendorf Co., and six gondolas for the U. S. Cast Iron Pipe and Foundry Co., with the American Car and Foundry Co. The Long Island has issued a call for 110 passenger cars. The Alton & Southern bought one Mikado engine from the American Locomotive Co. and the New York, Chicago & St. Louis two dining cars from the Pullman Car and Manufacturing Co.

Signal orders comprised an interlocking machine for the Montreal Tramways Co., placed with the General Railway Signal Co. and a similar device for the Seaboard Air Line, with the Union Switch and Signal Co.

The Western Maryland contemplates buying 20 Decapod locomotives; the Norfolk Southern is inquiring for three consolidation type engines; the New York Central wants 70 locomotive tenders and the Terminal Railroad Association of New Jersey four locomotive boilers. The Argentine State Railways are inquiring for 50 caboose cars; the Conley Tank Car Co. for 100 tank cars. The Wabash is inquiring for 5,600 kegs of track spikes and 1,600 kegs of bolts.

The Standard Tank Car Co. has received orders for 700 tank cars from the Phillips Petroleum Co. of Tulsa, Okla. This is the second largest order for tank cars placed in this country in past two years. The cars will have a capacity of 10,000 gal. each.

Among car orders placed were: Buffalo, Rochester & Pittsburgh, 500 steel hoppers, with the American Car and Foundry Co.; Harwick Coal and Coke Co., 225 mine cars, with the Hockensmith Wheel and Mine Car Co., and 100 with the American Car and Foundry Co.; E. E. White Coal Co., 100 mine cars, with the Watt Car and Wheel Co.; Crystal Coal and Coke Co., 50 mine cars, with the Hockensmith company. Inquiries included ten baggage cars, five combination horse, baggage and automobile cars and two baggage and postal cars for the Union Pacific, and eight baggage cars for the Chicago & Northwestern.

Calendar of Local Meetings

Society of Automotive Engineers

Cleveland Section. Nov. 29. "The Engineer, the Trade and the Owner," by David Beecroft.

National Association of Cost Accountants

Boston Chapter. Nov. 18, national officers night.

Buffalo Chapter. Nov. 18. Subject: "Credit via the Balance Sheet," and "Insurance—Cost and Distribution," by W. F. Chase and Frank Vockrodt.

San Francisco Chapter. Nov. 22. Subject: "Cost Accounting for Special Services as an Aid to Management."

Milwaukee Chapter. Nov. 18. Subject: "Standard Costs," by E. A. Camman.

Philadelphia Chapter. Nov. 19. Subject: "New Uses of Insurance," by Dr. S. S. Huebner.

Detroit Chapter. Nov. 18. Subject: "Financial Control Policies of the General Motors Corporation," by Albert Bradley.

Hawaii Chapter. Nov. 23. Subject: "Problem of Business Forecasting," by Prof. G. R. Kinnear, University of Hawaii.

American Society of Mechanical Engineers

Philadelphia. Nov. 23. Power Meeting, speaker, N. E. Funk.

New York. Nov. 23. Engineering Societies' Bldg. Subject: "Recent Progress in Air Transportation," by J. E. Whitbeck; "Safety in Air Transport," by J. T. Trippe.

Forthcoming Meetings

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

National Founders Association. Thirtieth annual convention, Hotel Astor, New York, Nov. 17 and 18. J. M. Taylor, secretary, 29 South La Salle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 6 to 9. Calvin Rice, secretary, 29 West 39th St., New York.

National Exposition of Power and Mechanical Engineering. Fifth event, Grand Central Palace, New York City, Dec. 6 to 11. I. E. Moultrop, chairman advisory committee, Edison Electric Illuminating Co., Boston, Mass.

American Association for the Advancement of Science. Annual meeting University of Pennsylvania, Philadelphia, Pa., Dec. 27 to Jan. 1. Sam Woodley, executive assistant, Smithsonian Institution, Washington, D. C.

Society of Automotive Engineers. Annual meeting, Detroit, Jan. 25 to Jan. 28. W. Delchamps, chairman, meetings and sections department, 29 West 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

BETTER demand appears in pig iron in the Southern districts, while prices are firmer at Pittsburgh. The small volume of inquiries in the New York market indicate that higher fuel costs have not induced widespread buying to cover further advances in price. Scrap continues dull and demand is slow for steel bars, strips and automotive material. Most of the slowing down is seasonal and steel rails are evidently the most active material in the market. Prices are down this week in fabricated brass and copper and non-ferrous metal scrap. Abrasives also took a drop in the Chicago market. Linseed oil rose 0.2c. per lb. at New York during the last week.

(All prices as of Nov. 12)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.89
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.19
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.76
Basic	20.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.40	3.50	3.25	3.89
No. 12	2.45	3.55	3.30	3.94
No. 14	2.50	3.60	3.35	3.99
No. 16	2.60	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.90	3.75	3.60	4.15
No. 22	3.05	3.90	3.75	4.30
No. 24	3.10	3.95	3.80	4.35
No. 26	3.20	4.05	3.90	4.45
No. 28	3.35	4.20	4.05	4.60
Galvanized				
No. 10	3.25	4.10	3.95	4.40
Nos. 12 to 14	3.35	4.20	4.05	4.50
No. 16	3.45	4.30	4.15	4.60
No. 18	3.60	4.45	4.30	4.75
No. 20	3.75	4.60	4.45	4.90
No. 22	3.80	4.65	4.50	4.95
No. 24	3.95	4.80	4.65	5.10
No. 26	4.20	5.05	4.90	5.35
No. 28	4.45	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	1	1½	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 1/16, 8.35c.; ¼, 7.85c.; 5/16 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.12½
Tin, 5-ton lots, New York			72.00
Lead (up to carlots) E. St. Louis	7.80	New York	8.62½
Zinc (up to carlots) E. St. Louis	7.22½	New York	8.12½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	15.50	19.50	15.00
Copper sheets, base	22.50	22.25	22.50
Copper wire, base	19.50	19.50	16.12½
Copper bars, base	22.12½	22.12½	22.12½
Copper tubing, base	24.50	24.50	24.50
Brass sheets, base	18.87½	18.87½	18.87½
Brass tubing, base	23.75	23.75	23.25
Brass rods, base	16.62½	16.62½	16.62½
Brass wire, base	19.37½	19.37½	19.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.25	13.05	12.01
Solder (½ and ½), (case lots)	42.50	44.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	89.00
Commercial genuine, intermediate grade	63.00
Anti-friction metal, general service	32.50
No. 4 babbitt (f.o.b.)	14.00

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	39.00
Shot	36.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.00 @12.25	11.25	11.00@11.50
Copper, heavy, and wire	11.00 @11.75	11.50	10.25@10.75
Copper, light, and bottoms	9.62½@10.12½	9.75	9.25@ 9.75
Heavy lead	6.50 @ 7.00	6.75	6.50@ 7.00
Tea lead	4.50 @ 4.75	4.75	5.50@ 6.00
Brass, heavy, yellow	6.75 @ 7.25	7.25	6.75@ 7.25
Brass, heavy, red	9.25 @ 9.75	9.50	9.00@ 9.50
Brass, light	5.50 @ 6.00	6.25	6.00@ 6.50
No. 1 yellow rod turnings	7.75 @ 8.25	8.00	7.50@ 8.00
Zinc	4.25 @ 4.75	4.50	3.75@ 4.25

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0.20
Cotton waste, colored, per lb.	.10@ .14	.13½	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	2.70†	3.50	4.25‡
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.86½	.98	.85
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. keg. †In 150-lb. bags. ‡Per 425 lb. barrel.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb.	.1662½	.1687½	.1737½
Solder (½ and ½)	per lb.	.425	.4362½	.40
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.13
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.32
Cloth	3.10	3.50	3.05
Fire clay, per 100 lb. bag		.60	75
Coke, prompt furnace, per net ton	Connellsville,		5.00@5.50
Coke, prompt foundry, per net ton	Connellsville,		6.00@7.00
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry	100 lb. kegs	New York,	15.25
Red lead, in oil	100 lb. kegs	New York,	16 75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{7}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{7}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ¾-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ¾-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Cairo — E. L. Bruce Co., Thomas St., Memphis, Tenn., W. W. Partee, Purch. Agt.—16 or 20 in. backgeared shaper, and 18 or 20 in. swing, 10 or 12 ft. bed lathe for machine shop.

Ind., Connersville — McQuay & Norris, (bearings for automobiles) — machinery and lathes for proposed factory. Estimated cost $40,000.

Mass., Boston — M. A. Costello, 1310 Boylston St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $50,000.

Mass., Brookline (Boston P. O.)—J. H. Larkin, 206 Corey Rd.—pipe threading machine, up to 6 in.

Mass., Cambridge (Boston P. O.)—I. S. Stone, 53 State St., Boston—tools and general equipment for proposed repair and service garage at 367 Cambridge St., here. Estimated cost $40,000.

Mich., Ferndale—H. Walker, 466 Pearson Ave.—screw cutting lathe, with or without motor.

Pa., Philadelphia—Dept. of Transit—two electric operated traveling cranes, 20 ton capacity each.

Wis., Milwaukee — G. W. Browns, 146 Broadway—complete equipment for proposed 3 story, 120 x 120 ft. repair and service garage. Estimated cost $150,000.

Wis., Port Washington—J. E. Gilson Co. (hot air furnaces)—sheet metal working machinery.

Ont., Toronto—Bd. of Education, W. W. Pearse, 155 College St., Secy.—lathes, drills, shapers, shears and other equipment (later) for proposed 3 story technical and high school of commerce. Total estimated cost $1,152,000.

Opportunities for Future Business

Calif., Berkeley—B. F. Sturtevant Co., Monadnock Bldg., San Francisco, manufacturers of blowers, fans and machinery, plans the construction of a factory at Camelia, Ninth, Eighth and Gilman Sts. here. Estimated cost $100,000.

Calif., Los Angeles—Chapman Bros. Co., 3469 West 6th St., is having revised plans prepared for the construction of a 5 story, 90 x 275 ft. garage. Estimated cost $150,000. R. H. Orr, 1305 Corporation Bldg., Archt. Noted Oct. 21.

Calif., Oakland—City, E. K. Sturgis, Clk., is receiving bids for the construction of a machine shop at Fallon and Ninth Sts. Estimated cost $30,000.

Calif., Oakland—De Sanno Foundry & Machine Co., 2941 East 12th St., has acquired a site and plans the construction of a foundry and machine shop on East 14th St. Estimated cost $40,000.

Calif., Sacramento—County Supervisors, H. W. Hall, Clk., will receive bids until Nov. 24 for the construction of a warehouse and machine shop.

Conn., Stamford—Allen Bros Garage Inc., 741 Main St., awarded contract for the construction of a 2 story, 50 x 100 ft. repair and service building. Estimated cost $40,000.

Ind., Indianapolis—Peerless Foundry Co., 1853 Ludlow Ave., awarded contract for the construction of a 1 story, 67 x 182 ft. foundry. Estimated cost $40,000.

Ind., Indianapolis—Schwitzer & Cummins, 1125 Massachusetts Ave., manufacturers of automobile parts, awarded contract for the construction of a 1 story, 200 x 300 ft. factory. Estimated cost $46,000.

Ind., Terre Haute—Cole Auto Co., 6th and Walnut Sts., is receiving bids for the construction of a 1 story, 85 x 195 ft. machine shop, garage, etc. Estimated cost $42,000. Johnson-Miller & Yeager, 30 North 5th St., Archts.

Md., Baltimore—Ramp Building Corp., 21 East 40th St., New York, N. Y., awarded contract for the construction of a 5 story, 100 x 100 ft. garage at Water and South Sts. here. Estimated cost $150,000. Noted Mar. 4.

Mass., Boston—American Steam Gage & Valve Mfg. Co., 80 Federal St., will build a 3 story addition to plant on Camden St. Estimated cost $40,000. Krokyn, Browne & Rosenstein, 220 Devonshire St., Archts.

Mass., Boston—Pierce Arrow Co., 896 Commonwealth Ave., will soon award contract for the construction of a 3 story, 100 x 300 ft. garage, sales service station. Estimated cost $400,000. H. C. Cook, 408 Pearl St., Buffalo, N. Y., Archt. Noted Oct. 21.

Mass., Cambridge (Boston P. O.)—L. Blais c/o R. C. Grovestein, 5 Brattle St., Archt., is having plans prepared for the construction of a repair and service garage at Church St. and Harvard Sq. Estimated cost $45,000.

Mass., Cambridge (Boston P. O.) — G. Brundage, 87 Austin St., will build a 2 story, 35 x 90 ft. work shop near Central Sq. Estimated cost $40,000. Private plans.

Mass., Everett (Boston P. O.)—L. Erikson Electric Co., 7 Portland St., manufacturers of electrical appliances, is having plans prepared for the construction of a 2 story, 50 x 160 ft. factory at Terminal St. and Revere Beach Blvd. Estimated cost $65,000. Private plans.

Mass., Framingham — Edison Electric Illuminating Co., 39 Boylston St., Boston, awarded contract for the construction of a 1 and 2 story garage and repair shop on Marble St. here. Estimated cost $50,000.

Mass., New Bedford—W. Thompson, c/o J. S. McIntyre, Times Bldg., Archt., is receiving bids for the construction of a 1 story, 40 x 110 ft. repair and service garage at Second and High Sts. Estimated cost $40,000.

Mass., Newton (Boston P. O.)—J. E. Calanar, Washington St., awarded contract for the construction of a 2 story, 60 x 105 ft. garage and repair shop. Estimated cost $40,000.

Mass., Newton (Boston P. O.)—N. T. Turner, 69 Elmwood Ave., awarded contract for the construction of a 2 story garage and repair shop on Washington St. Estimated cost $50,000. Noted Nov. 4.

Mass., Roxbury (Boston P. O.)—P. K. Finegold, c/o Eisenberg & Feer, 46 Cornhill, Boston, Archts., is receiving bids for the construction of a 1 story addition to repair and service garage at 8 Dunlow St. here. Estimated cost $40,000.

Mass., Saugus (Lynn P. O.)—Eastern Tool Stamping Co., Ballard St., will build a 1 story addition to factory. Private plans.

Mass., Worcester—Johnson Steel & Wire Co., c/o G. S. Johnson, 22 Lake Ave., awarded contract for the construction of a 2 story, 60 x 100 ft. factory.

Minn., St. Paul—City is having plans prepared for the construction of an 85 x 100 ft. airplane hanger and machine shop on airplane field. Estimated cost $35,000.

Mo., Kansas City—Dwight Estate, 660 Board of Trade Bldg., plans the construction of a garage at 911-13 Wyandoth St. Estimated cost to exceed $150,000. Architect not selected.

Mo., Liberty—E. E. Bell, will build a 2 story, 100 x 150 ft. garage. Estimated cost $200,000. Private plans.

Mo., St. Louis—International Harvester Co., 2508 North Broadway, awarded contract for the construction of a 1 story, 170 x 200 and 52 x 80 ft. service building at 4000 West Pine Blvd. Estimated cost $100,000.

N. J., Morris Plains—State Dept. Institutions & Agencies, W. J. Ellis, Comr., Trenton, plans the construction of a 1 story, 30 x 60 ft. industrial plant for Morris Plains State Hospital, Greystone Park, here. Estimated cost $60,000. C. N. Leathem, State Bldg., Trenton, Archt.

O., Mansfield—Barnes Mfg. Co., 701 North Main St., awarded contract for the construction of a 1 story, 52 x 185 ft. foundry. Estimated cost $75,000. Noted Nov. 11.

O., Massillon—Wagner Auto Garage Co., C. W. Wagner, Mgr., is having plans prepared for the construction of a 1 story, 124 x 220 ft. sales and service station. Estimated cost $150,000. Albrecht & Wilhelm, 1836 Euclid Ave., Cleveland, Archts. Noted Oct. 14.

O., Moraine City (mail West Carrollton) General Box Co., 508 North Dearborn St., Chicago, Ill., manufacturers of wooden boxes, will soon receive bids for the construction of a factory here. Estimated cost $50,000.

O., Norwood—A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt., is receiving bids for the construction of a 2 story, 125 x 425 ft. auto body plant and service building for Chevrolet Motor Co.

Pa., Lansdale—Andale Engineering Co., 1600 Arch St., Philadelphia, awarded contract for the construction of a 1 story, 92 x 102 ft. factory here. Estimated cost $40,000.

Pa., New Castle—National Radiator Co., R. S. Waters, Secy., Johnstown, awarded contract for the construction of a plant including 180 x 356 ft. foundry, 24 x 130 ft. coke shed, 190 x 432 ft. assembly and shipping room, etc. all 1 story here. Estimated cost $450,000.

Pa., Pittsburgh—John Murphy & Co., 51 Chatham St., manufacturers of undertakers' supplies, awarded contract for the construction of a 2 story, 78 x 127 ft. plant and warehouse. Estimated cost $40,000.

Pa., Pittsburgh—National Tube Co., Frick Bldg., soon receives bids for the construction of a 2 story, 58 x 109 ft. research laboratory on Forbes St. Estimated cost $150,000. E. Stotz, Monon Bank Bldg., Archt.

R. I., Pawtucket—W. J. Dunn, Academy Bldg., Fall River, Mass., will build a repair and service garage here. Estimated cost $40,000. E. G. Bullard & Sons, 908 Purchase St., New Bedford, Archts.

Tex., Brenham—H. P. Fisher, El Campo, is having plans prepared for the construction of a broom factory. Estimated cost $30,000. Private plans.

Tex., Galveston—Quartermaster General, War Dept., Washington, D. C., is having preliminary plans prepared for the construction of a machine shop for U. S. Air Service here. Estimated cost including equipment $100,000.

Wis., Cottage Grove — E. Whiting, awarded contract for the construction of a 2 story, 60 x 150 ft. service station. Estimated cost $40,000. Noted Nov. 4.

Wis., Madison—J. A. Ryden, 611 Milwaukee St., is having plans prepared for the construction of a 2 story, 40 x 117 ft. service station. Estimated cost $40,000. M. P. Schneider, 401 West Doty St., Archt.

Wis., Milwaukee—White Co., 842 East 79th St., Cleveland, O., awarded contract for the construction of a 1 story, 142 x 170 ft. garage and service station on Clybourn St., here. Estimated cost $85,000. Noted Oct. 7.

Ont., London—Richards Wilcox Canadian Co., W. R. Yendall, Mgr., manufacturers of hardware specialties, plans the construction of addition to factory on Chelsea Green. Estimated cost $50,000. Private plans.